FY 90
R&D PROJECT DESCRIPTIONS
ESL ENVIRONICS DIVISION

JULY 1989

AFESC

AIR FORCE ENGINEERING & SERVICES CENTER
ENGINEERING & SERVICES LABORATORY
TYNDALL AIR FORCE BASE, FLORIDA 32403

PREFACE

The Environmental Quality R&D Project Descriptions for fiscal year 1990 are to be used in program management and to assist in coordination within the Air Force, with the other military services, and with appropriate federal agencies. Written comments or inquiries should be directed to Headquarters Air Force Engineering and Services Center, Environics Division (HQ AFESC/RDV), Tyndall AFB FL 32403-6001. Project officers may be telephoned directly with questions on individual projects.

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This document has been reviewed and approved for publication.

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SECTION I

LABORATORY MISSION

The Engineering and Services Laboratory is the lead Air Force laboratory for research, development, test, and evaluation (RDT&E) for civil engineering and environmental quality technology.

The mission of the laboratory affects virtually all segments of the Air Force mission: readiness, airbase operability, airfield maintenance, fire protection/rescue, facilities energy, and environmental quality. The technology to provide for the launch of mission aircraft under wartime contingency operations with follow-on repair of bomb-damaged runways is vital. Equally important are the technologies that enable our aircraft and support facilities to meet environmental pollution standards and continue operations during peacetime. The environmental research program is focused on the reduction, recovery, and treatment of hazardous wastes, as well as installation restoration technologies. Special emphasis is given to hazardous waste minimization and cleanup of polluted soils and groundwaters.

SECTION II

ENVIRONICS DIVISION

A. RESPONSIBILITY

The Environics Division of the Engineering and Services Laboratory is responsible for Air Force Environmental Quality Research and Developmental Programs. The objective of the Environmental Quality Program is to investigate and provide the technology base to meet federal and state environmental regulations and solve environmental problems. The intent is to ensure that the ability of the Air Force to accomplish its mission is not compromised by delays from environmental litigation, and that deployment of Air Force weapons systems and the operation of Air Force facilities do not cause environmental degradation. The Environics Division is Air Force Systems Command's lead agency for environmental quality research and development (R&D) and is also the focal point for all Air Force environmental quality R&D. It coordinates this broad program with other DOD and federal agencies. The Environics Division works closely with the major commands (MAJCOMs), the Occupational and Environmental Health Laboratory, and other Air Force laboratories to solve existing problems in the most cost-effective manner, and to anticipate and avoid potential environmental consequences of future Air Force weapon systems.

B. PROGRAMS AND CAPABILITIES

The staff of the Environics Division consists of engineers, chemists, microbiologists, and other scientists. Research funds are applied to in-house projects and extramurally with universities, commercial research organizations, and other federal agencies. In-house research is conducted in atmospheric, soil, and groundwater chemistry, microbial degradation, and groundwater and industrial waste treatment. The laboratory can analyze trace organics and metals in natural water and ambient environments. The laboratory is equipped to evaluate bench-scale chemical, physical, and biological processes for control of toxic industrial wastes and the testing of systems to remove trace contaminants from groundwaters. Most pilot-scale and prototype technologies are evaluated onsite, at the source of the pollutants.

C. HQ AFESC/RDV PERSONNEL AND FUNDING PROJECTIONS

Personnel

Number Authorized as of July 1988

Officers	Airmen	Civilians	Term	Total
10	2	13	15	40

Number Assigned as of March 1988

Professional Category	Officers	Airmen	Civilians	Term	Total
S&E	13	0	11	5	29
Technicians	0	1	0	1	2
Other	0	1	1	3	5
TOTAL	13	2	12	9	36

Education	Officers	Airmen	Civilians	Term	Total
Doctorates	3	0	7	3	13
Masters	9	0	3	2	14
Bachelors	1	1	1	0	3
No Degree	0	1	1	4	6
TOTAL	13	2	12	9	36

D. TECHNICAL APPROACH

The technical approach is to investigate, understand, and model the basic phenomena underlying the pollution generation, transport, and control process. This includes identifying the source and character of significant emissions; evaluating pollutant life cycle interactions; defining environmental mechanisms which control transport and chemical reactions; developing control, detection, monitoring, disposal, recovery, recycling, and abatement technology; and addressing environmental assessment and impact evaluation techniques using a systematic interdisciplinary approach for decision making.

Special emphasis is given to hazardous waste minimization and cleanup of polluted soils and groundwaters. Technology is under development for rapid assessment of accidental toxic vapor releases and measurement of pollutants from Air Force weapon systems. In addition, the Laboratory is continuing to develop environmental fate data on present Air Force aircraft fuels and rocket propellants, and is investigating future fuels.

Technology will be developed under each of two major thrusts. Each area has major supporting tasks.

1. Site Restoration

   - Remedial Action Technologies
   - Contaminant Fate and Transport
   - Site Characterization and Investigation

2. Environmental Compliance

   - Environmental Impact Assessment
   - Pollution Control
   - Hazardous Waste Reduction

The general criteria to be followed in carrying out the R&D efforts are as follows:

(1) Develop the technology and hardware necessary to assess, control and/or abate pollution from operations, facilities, or equipment unique to the Air Force, thus, meeting applicable environmental standards where operations or equipment may be adversely restricted or impacted because of lack of commercial solution.

(2) Develop data pertinent to Air Force operations to serve as the basis for new standards or criteria, or to modify existing standards or criteria that appear to be based upon inadequate data.

(3) Develop R&D programs to make present pollution abatement technology more timely and cost-effective.

(4) Engage in R&D efforts necessary to evaluate and extend the technology base in a specific pollution abatement area where the Air Force has unique expertise or equipment not available to the civilian community. Criteria 1 and 2 are most important. In all cases, the Air Force will participate in joint R&D efforts with organizations engaged in mutually beneficial environmental projects.

SECTION III
R&D PROJECT DESCRIPTIONS

A. PROJECT DESCRIPTION INDEX

THRUST: Site Restoration

TECHNICAL AREA: Contaminant Fate and Transport

TITLE: Solvent Transport Mechanisms

WORK UNIT: 01008304

OBJECTIVE: To predict the groundwater transport of hazardous wastes, solvents, and nonpolar organic chemicals that are found in Air Force jet fuels, it is necessary to understand the chemical and physical interactions between these chemicals and soil materials. A quantitative knowledge of sorption, sorption kinetics, advection, dispersion, hydrolysis, and chemical reactions will provide the necessary data to predict the transport of these pollutants. Transport predictions enable informed decisions for selection of remedial actions and assessment of risks to drinking water supplies.

APPROACH: The movement or transport of contaminants in groundwater is a major concern. In low-organic aquifer systems, there is no way to predict the movement of organic contaminants by physical/chemical characterization of the aquifer material. Contaminant transport must then be predicted by either static (batch) methods or dynamic (column) methods. The two methods do not appear to give comparable results. The goal is to determine what chemical processes cause this disparity and the ramifications to groundwater transport of Air Force contaminants. The approach is to conduct parallel batch and dynamic experiments under carefully controlled conditions. Parameters to be evaluated are materials used in construction of the chromatographic system, mass balance of contaminants, chemical stability of aquifer material, and sorption kinetics. Chemical contaminant breakthrough curves will be analyzed and fitted to an advection-dispersion equation for rate-limited transport in porous media. Rate constants can then be compared to those obtained by independent methods to determine the validity of local sorption equilibrium as a possible explanation for any observed differences.

START DATE: Jun 88 FINAL PRODUCT DUE DATE: Nov 91

WORK CONDUCTED BY: In-house

MILESTONES:

1.	Low-Molecular-Weight Compound Transport	Mar 89
2.	Sorption Spatial Variability	Oct 89
3.	Column Studies of High-Molecular-Weight Sorbates	Mar 90
4.	Enhanced Transport Due to Dissolved Organic Matter (DOM)	Oct 91
5.	Final Report	Nov 91

PROJECT OFFICER: Dr. Thomas B. Stauffer, RDVW, (904) 283-4297, AUTOVON 523-4297

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Factors Influencing Biodegradation Kinetics and Pathways

WORK UNIT: 01008320

OBJECTIVE: Chlorobenzenes are EPA priority pollutants and are major contaminants of concern to the Air Force. Researchers at AFESC have recently isolated bacteria able to degrade chlorobenzene and 1,4-dichlorobenzene. The objective of this research is to extend the range of chemicals degraded by the isolate.

APPROACH: Recent advances in biotechnology allow the development of microorganisms able to degrade previously recalcitrant xenobiotic compounds. Site-directed mutagenesis, plasmid transfer, and novel selection techniques will be used to change enzyme specificity, alter patterns of induction, and recruit enzymes from unrelated organisms to carry out biotransformation. Through the use of extended selection at low substrate concentrations, the substrate range of the isolate has been extended to include p-chlorotoluene and chlorobenzoate. We expect to further extend the range of chlorinated organic compounds degraded by these organisms. Development of organisms able to degrade a variety of chloroaromatic compounds will allow the use of biological systems at waste sites that contain mixtures of toxic chemicals.

START DATE: Oct 87 FINAL PRODUCT DUE DATE: Oct 92

WORK CONDUCTED BY: In-house

MILESTONES:

1.	Methods Development and Preliminary Experiments	May 88
2.	Selection and Isolation of Specific Microbes	Sep 89
3.	Evaluation of Biodegradation Pathways and Kinetics	Oct 91
4.	Studies with Mixtures of Chemicals	Oct 91
5.	Preliminary Scale-Up Studies	Sep 92
6.	Final Report	Oct 92

PROJECT OFFICER: Dr Jim Spain, RDVW, (904) 283-2982, AUTOVON 523-2982

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: The Deactivation of Oxidation Catalysts Used to Control Air-Stripping Emissions

WORK UNIT: 19002101

OBJECTIVE: Develop quantitative and predictive methods to estimate the deactivation of catalysts used in catalytic oxidation systems. This research effort will determine:

a. The best catalyst for a given air-stripping operation
b. The oxidized product distribution as a catalyst deactivates
c. Appropriate operating conditions to slow catalyst deactivation
d. Prediction of catalyst lifetime
e. Development of a standard catalyst test protocol

APPROACH: This effort will investigate different catalysts for their effectiveness and deactivation potential when destroying VOC contaminants. A previous study demonstrated that catalytic oxidation could be used for destroying air-stripper emissions. However, the study did not investigate different catalysts to determine which is best suited for a given air emission stream. The best catalysts for a given emission stream would completely oxidize the contaminants at the lowest temperature while deactivating at the slowest rate. This study will test various catalysts against compositions expected from Air Force groundwater air-stripping emissions streams. The study will involve determining which catalysts are best suited for different types of operation. The operating conditions will be varied and deactivation modeled so that catalysts' lives can be predicted. Also, the distribution of oxidized products will be investigated to determine how it is affected by the age of the catalysts, the operating conditions, and the type and concentrations of contaminants entering the catalytic system. Investigating these effects will provide information for selecting the best catalysts for a given emissions stream, while allowing prediction of when the catalysts must be replaced.

START DATE: Jun 89 FINAL PRODUCT DUE DATE: Aug 91

WORK CONDUCTED BY: Research Triangle Institute
Research Triangle Park NC

MILESTONES:

1.	Catalysts Obtained	Sep 89
2.	Experiments Completed	May 91
3.	Final Report	Aug 91

PROJECT OFFICER: 1Lt Edward G. Marchand, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Site Restoration

TECHNICAL AREA: Contaminant Fate and Transport

TITLE: Organic Pollutant Transport Predictions for Groundwater Systems

WORK UNIT: 19004014

OBJECTIVE: Organic pollutant transport predictions for groundwater systems are often based on information collected from laboratory-scale experiments. No information is available to assess how well data from these small-scale columns predict actual transport in a field situation. This research will study transport of organic chemicals in intermediate-scale systems to determine any differences between laboratory-scale columns and intermediate-scale columns, and identify processes causing the difference.

APPROACH: Laboratory-scale transport studies generally use columns of approximately 2.54 cm (1-inch) diameter. This study will use columns of approximately 1 meter (39 inches) diameter. Increasing the diameter will minimize wall effects and column-end effects. Minimizing these errors should produce better data. Parallel studies between the small and large columns with similar soils and organic chemicals should show if the small-column data are seriously flawed. Results will provide data on scaling effects in column transport studies.

START DATE: Oct 88 FINAL PRODUCT DUE DATE: Sep 91

WORK CONDUCTED BY: Los Alamos National Laboratory
Los Alamos NM

MILESTONES:

1.	Literature Review	Dec 88
2.	Column Fabrication	Jun 89
3.	Single Organic Transport Studies	Aug 89
4.	Multiple Solute Studies	Aug 90
5.	Model Modification	Jan 91
6.	Final Report	Sep 91

PROJECT OFFICER: Dr. Thomas B. Stauffer, RDVW, (904) 283-4297, AUTOVON 523-4297

THRUST: Site Restoration

TECHNICAL AREA: Contaminant Fate and Transport

TITLE: Fate of Tetraethyl Lead in Soils

WORK UNIT: 19007039

OBJECTIVE: Determine the transformations and sorption properties of tetraethyl lead (TEL) in soils. This study will provide data which will be used to predict the migration of TEL in soil and groundwater.

APPROACH: This research effort will consist of: (1) a literature review on the fate and behavior of TEL in the environment, (2) sludge (containing TEL) disposal site review and characterization, and (3) laboratory studies on the physicochemical characteristics of TEL for predicting its fate and transport in the environment. The laboratory studies will include washout, sorption, and biodegradation investigations of TEL-contaminated soils. This project is needed to access the possible environmental impact of past disposal practices of TEL sludge in burial pits.

START DATE: May 90 FINAL PRODUCT DUE DATE: May 91

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Literature Review	Jun 90
2.	Disposal Site Characterization	Oct 90
3.	Laboratory Studies Complete	Mar 91
4.	Technical Report	May 91

PROJECT OFFICER: 1Lt Michael .. Elliott, RDVW, (904) 283-4628, AUTOVON 523-4628

THRUST: Site Restoration

TECHNICAL AREA: Site Characterization and Investigation

TITLE: Research and Development Support for Subsurface Monitoring Technology

WORK UNIT: 19007047

OBJECTIVE: Provide technical support for research, development, evaluation, and demonstration of sensors and advanced monitoring techniques with potential for application to low-cost, long-term, in situ subsurface monitoring at Air Force facilities. This project will identify and evaluate the state-of-the-art of both commercially available and promising, emerging technologies applicable to the Air Force's monitoring requirements. Emphasis will be on innovative technology that will be simple, reliable, and relatively low-cost as compared to present methods. The instruments will provide near real-time data; they will be easily operable by personnel with minimal training.

APPROACH: One monitoring method to be evaluated will be the measurement of carbon dioxide (CO_2) concentrations for detection of organic contamination and biodegradation. It has also become apparent that test methods are required to evaluate monitoring systems. An inexpensive test bed with easily replicated and controlled parameters, is required to evaluate and compare devices. Laboratory apparatus and methodology will be developed for evaluation of subsurface monitoring technology, with this project emphasizing vadose zone systems.

START DATE: Apr 89 FINAL PRODUCT DUE DATE: May 91

WORK CONDUCTED BY: EPA Environmental Monitoring Systems Laboratory
Las Vegas NV

MILESTONES:

1.	Tasks I and II - Draft Work Plans	May 89
2.	Task I - CO_2 Soil Gas Study	Apr 90
3.	Task II - Test Apparatus & Methodology Development	Mar 91
4.	Final Report	May 91

PROJECT OFFICER: Mr Bruce J. Nielsen, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Pumping and Purging Contaminants

WORK UNIT: 19007048

OBJECTIVE: Formulate a methodology for determining the most efficient and cost-effective pumping schemes for cleaning up contaminated aquifers. The methodology developed from this project will enable engineers to systematically determine: (1) the optimum number of extraction and injection wells, (2) the optimum locations for the wells, (3) their optimum pumping rates, and (4) the time when the pumps should be turned off or pumping rates reduced. The optimum pumping schemes developed from this methodology will reduce the time and cost of cleaning up contaminated aquifers.

APPROACH: A panel of experts in hydrogeology and aquifer restoration will formulate a methodology for determining the most efficient and cost-effective pumping schemes to clean up contaminated aquifers. A document will be produced and will present, in detail, the steps required to determine the optimum pumping scheme (i.e., number, location, and pumping rates of extraction and injection wells) for cleanup of any contaminated aquifer. Testing will use actual Air Force contaminated groundwater sites as examples. This document will enable engineers to design extraction/injection well fields and treatment systems in the most efficient and cost-effective manner.

START DATE: Jun 88 FINAL PRODUCT DUE DATE: Jun 90

WORK CONDUCTED BY: DOE-INEL
Grand Junction CO

MILESTONES:

1.	Research Start Date	May 88
2.	Methodology Developed	Jun 89
3.	Examples Worked	Nov 89
4.	Final Report	Jun 90

PROJECT OFFICER: 1Lt Michael G. Elliott, RDVW, (904) 283-4628, AUTOVON 523-4628

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Methods for Selecting In Situ Treatment Chemicals

WORK UNIT: 19007049

OBJECTIVE: Develop methods for selecting chemicals to enhance in situ biodegradation of subsurface contaminants. Chemicals currently used for in situ treatments can react with certain minerals, clogging the soil formation or mobilizing of toxic metals. This program will develop a methodology to select chemicals compatible with the subsurface environment. Investigations will also include studies of soil-conditioning methods to reduce the negative impact of these side reactions.

APPROACH: Literature review, chemical equilibrium modeling, and laboratory testing will form the basis for a multifaceted approach to identify in situ treatment chemicals and systems. Improved site characterization methods will help identify nutrient demand and potential adverse reactions. Alternatives to ammonium chloride and sodium phosphate nutrient formulas may reduce adverse side reactions in certain soil types. Diagnostic tests will be developed to select site-specific chemical formulations. Finally, chemical pretreatment to improve hydraulic conductivity will be investigated. All phases of this program will be incorporated into a comprehensive methodology to select the treatment chemicals and design the treatment system.

START DATE: Nov 88 FINAL PRODUCT DUE DATE: Jan 90

WORK CONDUCTED BY: Battelle Columbus
Columbus OH

MILESTONES:

1.	Literature Review	Jan 89
2.	Equilibrium Modeling	Mar 89
3.	Laboratory Testing Complete	Nov 89
4.	Final Report	Jan 90

PROJECT OFFICER: Mr Doug Downey, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Site Restoration

TECHNICAL AREA: Contaminant Fate and Transport

TITLE: Fate and Transport of Perchloroethylene

WORK UNIT: 19007051

OBJECTIVE: Identify the environmental fate of perchloroethylene in groundwater systems. Knowledge of its environmental fate may be used to develop cleanup strategies for past spills or leaks. The studies will also provide data to predict long-term distribution of low-concentration materials in groundwater. PCE fate and persistence data can be used to assess long-term effects in groundwater contamination situations.

APPROACH: Conduct in-house research studies on hydrolysis of hazardous components with emphasis on PCE. Measure sorption of the components to predict groundwater transport. Quantify leachates from bulk materials to assess the long-term environmental impact of solid waste polymers.

START DATE: Aug 87 FINAL PRODUCT DUE DATE: Sep 91

WORK CONDUCTED BY: In-house

MILESTONES:

1.	Literature Review	Oct 87
2.	PCE Hydrolysis Studies - Preliminary	Jan 88
3.	Transport Studies	Oct 90
4.	Detailed PCE Hydrolysis Studies	Jul 91
5.	Final Report	Sep 91

PROJECT OFFICER: Dr David Burris, RDVW, (904) 283-4297, AUTOVON 523-4297

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Catalytic Destruction of Chlorinated Volatile Organic Compounds (VOCs)

WORK UNIT: 19007056

OBJECTIVE: Develop catalytic systems (catalyst and support) capable of efficient, low-temperature destruction of hazardous chlorinated VOCs. Emphasis will be on obtaining high destruction and complete oxidation in a system with long-term stability.

APPROACH: Experiments are being carried out in bench-scale reactor systems using low-pressure drop monolithic supports treated with one or more transition metal oxide (TMO) catalysts. Products from oxidation of chlorinated VOCs are analyzed, using GC/MS techniques to determine the destruction efficiency and thermal stability, as well as the spectrum of products formed.

START DATE: Mar 89 FINAL PRODUCT DUE DATE: Mar 92

WORK CONDUCTED BY: Air and Energy and Engineering Research Laboratory (EPA)
Principal Investigator: University of Akron
Akron OH

MILESTONES:

1.	Screening Tests	Jun 89
2.	Performance Tests	Jun 90
3.	Mixed-Bed Tests	Jun 91
4.	Reactor Design	Oct 91
5.	Final Report	Mar 92

PROJECT OFFICER: 1Lt Edward G. Marchand, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Aphron Treatment Zones

WORK UNIT: 19007059

OBJECTIVE: Colloidal gas aphrons are a stable emulsion of air in water. The ability of aphrons to provide oxygen for in situ biodegradation will be proven. This research will develop and test prototype equipment and a methodology for supplying aphrons to the subsurface.

APPROACH: Bench-scale tests will be conducted to demonstrate the ability of aphrons to provide a higher mass loading of oxygen to groundwater. A vertical slice test cell will be used as well as a batch cell testing technique. Transport of the aphrons and their subsequent release of oxygen will be studied. Preliminary tests indicate aphrons displace groundwater and remain stable in the injection area, thus, creating an aphron zone through which contaminated groundwater may flow. The bench-scale tests will demonstrate the effectiveness of this zone in transferring oxygen and nutrients to the passing groundwater. Following successful bench-scale tests, various methods for supplying the aphrons to the subsurface will be evaluated. One of the major issues is whether the surfactant used to stabilize the aphrons has any adverse environmental effects.

START DATE: Jan 89 FINAL PRODUCT DUE DATE: Sep 90

WORK CONDUCTED BY: EPA/RREL
Principal Investigator: (Virginia Polytechnic Institute and State University)
Blacksburg VA

MILESTONES:

1.	Enhanced Oxygen Level Studies	Aug 89
2.	Long-Term Hydraulic Conductivity Studies	Jan 90
3.	Conventional Methods Cost-Effectiveness Comparison Study	Apr 90
4.	Delivery Systems and Methodologies	Jul 90
5.	Final Report	Sep 90

PROJECT OFFICER: Maj Tom Lubozynski, RDVW, (904) 283-4628, AUTOVON 523-4628

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Subsurface Enrichments for Biodegradation

WORK UNIT: 19007060

OBJECTIVE: This effort will test the use of nitrates as an alternative to oxygen for enhancing in situ biodegradation. Laboratory tests have shown that, in the absence of oxygen, bacteria will readily use nitrates as electron acceptors. Oxygen sources, such as hydrogen peroxide, are expensive and have been unstable in many soils. Nitrates are much more stable and more soluble in groundwater and should enhance the biological degradation of fuel hydrocarbons. The treatment efficiency and cost-effectiveness of this method will be determined.

APPROACH: A pilot-scale test of nitrate-enhanced biodegradation is now underway at a JP-4 spill site at Traverse City Coast Guard Station MI. A large infiltration gallery will be used to apply nutrients and nitrates to a subsurface JP-4 spill. Groundwater and soil samples will be taken throughout the project to measure the reduction in fuel concentrations over time. HQ AFESC/RDV, the EPA, and the Coast Guard are cosponsoring this research project, which has the potential for widespread application. If successful, a full-scale test of the technology will follow.

START DATE: Mar 89 FINAL PRODUCT DUE DATE: Dec 90

WORK CONDUCTED BY: EPA
R. S. Kerr Engineering Laboratory
Ada OK

MILESTONES:

1.	Site Characterization	Mar 89
2.	Start Pilot Test	May 89
3.	Complete Pilot Test	Nov 89
4.	Initiate Full-Scale Demonstration	May 90
5.	Complete Full-Scale Demonstration	Dec 90
6.	Final Report	Dec 90

PROJECT OFFICER: Mr Doug Downey, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Site Restoration

TECHNICAL AREA: Site Characterization and Investigation

TITLE: Advanced Fiber Optic Chemical Sensors (FOCS)

WORK UNIT: 19007063

OBJECTIVE: Several photonic sensors have been demonstrated to show specificity to a number of chemicals. Although the principles supporting this technology are sound, few of these sensors have reached maturity where they can be manufactured reproducibly. An effective model and database for FOCS will be developed to guide future research, development, and engineering.

APPROACH: A review of literature and unpublished information within the Department of Defense and and Department of Energy will be performed. Information will be incorporated within a database to assist in the research and development for FOCS designs. Information such as UV-VIS-NIR spectra for such phenomena as absorption, fluorescence, phosphorescence, and scattering will be obtained. Physical, chemical, and optical properties will be determined for fiber optic materials, contaminants, and groundwater. The effects of variables, such as temperature, stress, strain, pH, salinity, solubility, refractive index, and numerical aperture, will be ascertained. Significant design parameters and optical functions, such as Beer's Law, will be determined for designing the various FOCS configurations. A model and the associated database for each FOCS configuration will be organized so that they can be readily adapted and utilized as a design guide for developing FOCS for new applications. Laboratory investigations for developing a prototype instrument will emphasize analysis of aromatic hydrocarbons associated with aircraft fuels. Performance of FOCS designs, based upon design models and databases, will be determined and required changes to models, databases, and designs will be made. Specifications for one or more prototype instruments, using the final design guide, will be provided.

START DATE: Apr 89 FINAL PRODUCT DUE DATE: Dec 90

WORK CONDUCTED BY: University of Alabama
Huntsville AL

MILESTONES:

1.	Literature Review and Database Development	Nov 89
2.	Start Theoretical Calculations and Model Development	Jun 89
3.	Model Verification	Jan 90
4.	Complete Breadboard Design and Evaluation	Mar 90
5.	Prototype Specification	Sep 90
6.	Final Report	Dec 90

PROJECT OFFICER: Mr Bruce J. Nielsen, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Site Restoration

TECHNICAL AREA: Contaminated Fate and Transport

TITLE: Groundwater Transport Validation

WORK UNIT: 19007064

OBJECTIVE: This research will collect basic information on the transport of organic contaminants in groundwater. A field site will be developed to inject an organic tracer material into flowing groundwater and monitor plume migration for comparison of actual data to those predicted by groundwater transport models.

APPROACH: A field site will be selected and characterized by coring and installation of monitoring wells. Soil types, stratification, hydraulic conductivity, and permeability will be determined throughout the site in three dimensions. An organic tracer will then be released in a controlled manner. Since the source strength will be known and all other hydrodynamic and geological data can be obtained, all necessary data would be available to input to existing transport models. Observation wells will allow sampling of the transported organic to determine its actual concentration and location for comparison to predicted results. This research will allow a determination of the utility and prediction accuracy of the models.

START DATE: Apr 89 FINAL PRODUCT DUE DATE: Mar 92

WORK CONDUCTED BY: Tennessee Valley Authority
Norris TN

MILESTONES:

1.	Site Characterization	Jul 89
2.	Hydraulic Conductivity Studies	Jun 90
3.	Organic Tracer Transport Studies	Dec 91
4.	Final Report	Mar 92

PROJECT OFFICER: Mr Jack Milligan, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Site Restoration

TECHNICAL AREA: Site Characterization and Investigation

TITLE: Field Analysis of Aromatic Hydrocarbon Pollutants in Groundwater with a Portable Laser Fluorimeter

WORK UNIT: 19007066

OBJECTIVE: Determine the feasibility of using a transportable laser fluorimeter to monitor groundwater for contaminants. The major advantages of fiber optic methods are that they allow in situ, real-time analysis versus obtaining a sample with later laboratory analysis. Detection limit determinations for individual compounds, approaches to speciation, and identification of possible interferences will be developed.

APPROACH: A transportable laser fluorimeter will be constructed for in situ analysis of aromatic hydrocarbons. Aromatic hydrocarbons, such as benzene, toluene, and xylenes, are components of JP-4 jet fuel. Fluorescence is well established as an extremely sensitive analytical technique; in certain cases, sub-parts-per-billion detection limits have been demonstrated in the laboratory with a laser excitation source. Fluorescence is an optical technique and can be teamed with fiber optics for performing remote, in situ analysis of groundwater. A pulsed Nd:YAG laser with second and third harmonic generation output will pump turnable dye lasers with output, which will be frequency-doubled to provide the required 250-320 nm output to excite aromatic hydrocarbons to fluorescence. The two main areas of development for this project will be hardware and procedures. Hardware development involves laboratory integration of Nd:YAG laser, dye lasers, fiber optic probe, detection system, signal processors, computer control; the system will be built for field use. Laboratory procedures will include investigation of absorbance spectra, fluorescence spectra, fluorescence lifetimes, detection limits, interferences, synchronous scanning, and gas phase analysis. Examination of actual groundwater samples will also be accomplished. Field procedures will be similar to the laboratory effort and, in addition, will determine transport and set up requirements.

START DATE: Jun 89 FINAL PRODUCT DUE DATE: Feb 92

WORK CONDUCTED BY: North Dakota State University
Fargo ND

MILESTONES:

1.	Construction of Laboratory Laser Fluorimeter	Aug 89
2.	Laboratory Testing	Jun 90
3.	Laboratory Optimization and Database Development	Apr 91
4.	Second-Level Field Tests	Oct 91
5.	Technical Effort	Dec 91
6.	Final Report	Feb 92

PROJECT OFFICER: Mr Bruce J. Nielsen, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Liquid Phase Catalytic Oxidation of Organics

WORK UNIT: 1900VW06

OBJECTIVE: Perform a systematic scientific evaluation of various liquid-phase catalysis technologies that could be applied to cleaning up organic-contaminated groundwater.

APPROACH: Liquid-phase catalysis oxidizes the contaminants into CO_2, H_2O, and minerals in the water phase without further processing. This one-step process can be a cost-effective treatment technology. This study will examine the efficiencies and oxidant characteristics of various oxidation systems. The next step is to focus on methods for more efficiently generating the oxidants and testing different catalysts against a given waste stream. Finally, the study will yield the parameters necessary for an effective scale-up test of the most promising technologies.

START DATE: Jan 90 FINAL PRODUCT DUE DATE: Jan 92

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Evaluate Potential Technologies	Jan 91
2.	Test Improved Oxidation Systems	Nov 91
3.	Final Report	Jan 92

PROJECT OFFICER: 1Lt Edward G. Marchand, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Biodegradation of Mixed Chlorinated Solvents

WORK UNIT: 1900VW08

OBJECTIVE: Develop biological systems for degradation of mixtures of halogenated solvents. Researchers will determine the factors that control biodegradation in mixtures and develop an approach to use laboratory data for predicting biodegradation in the field. Results of this research will be used to predict the behavior of pollutants after accidental release, and will serve as a basis for biological treatment systems for remedial actions.

APPROACH: Bacteria that are able to degrade a wide variety of pure solvents and fuel components have been developed at AFESC. The organisms can completely destroy chlorobenzenes, chlorophenols, benzene, and toluene. Induction of appropriate metabolic pathways should lead to simultaneous degradation of mixtures of the chemicals. Biodegradation of substituted aromatic compounds will be studied in pure cultures and in microcosms designed to simulate bioreactor conditions. Kinetics and mechanisms of degradation will be determined to provide insight into pathways to be expected in mixed cultures. Subsequent experiments will be conducted with mixtures of chemicals under conditions similar to those in the bioreactors. Efforts will be undertaken to enhance biodegradation by alteration of conditions or by selection and modification of specific microorganisms.

START DATE: Oct 89 FINAL PRODUCT DUE DATE: Dec 91

WORK CONDUCTED BY: In-house

MILESTONES:

1.	Literature Review and Selection of Model Compounds	Jan 90
2.	Methods Development and Preliminary Biodegradation Experiments	May 90
3.	Initial Bioreactor Experiments with Two Chemical Components	Dec 90
4.	Optimization of Biodegradation	Jun 91
5.	Preliminary Studies with Multiple Components	Oct 91
6.	Final Report	Dec 91

PROJECT OFFICER: Dr Jim Spain, RDVW, (904) 283-2982, AUTOVON 523-2982

THRUST: Site Restoration

TECHNICAL AREA: Contaminant Fate and Transport

TITLE: Enhanced Transport Mechanisms for Hydrophobic Organics

WORK UNIT: 1900W90A

OBJECTIVE: Define the basic mechanisms of solubility enhancement for hydrophobic organic chemicals in soils, and determine their impact on the transport of groundwater contaminants.

APPROACH: Sorption is a major factor for understanding how chemical pollutants interact with the soil matrix. Current knowledge indicates soil organic carbon has the dominant role in controlling hydrophobic organic pollutant sorption, even in low-carbon content aquifer systems. However, hydrophobic organic pollutants can also sorb to colloidal solids and dissolved macromolecules. These materials are mobile in porous media and can, therefore, enhance or facilitate the transport of pollutants which they sorb. This study will investigate some of the likely macromolecules and colloids which occur in groundwater with respect to their ability to enhance the mobility of polynuclear aromatic hydrocarbons (PAH). Naphthalene, phenanthrene, and anthracene are examples of PAH compounds which may be found in JP-4. In particular, the research will focus on the interplay between pollutant hydrophobicity, media properties (such as porosity and carbon content), and colloid or macromolecule characteristics. It will define the subset of conditions under which enhanced transport can occur. Indigenous groundwater microorganisms and their extracellular polymeric materials are examples of colloids and macromolecules which will be utilized.

START DATE: Oct 89 FINAL PRODUCT DUE DATE: Oct 92

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Batch Sorption Screening	Mar 90
2.	Particle Detection Development	Oct 90
3.	Column Studies with Facilitators	Jan 91
4.	Mixed Facilitator Studies	Jan 92
5.	Final Report	Oct 92

PROJECT OFFICER: Dr Thomas Stauffer, RDVW, (904) 283-4297, AUTOVON 523-4297

THRUST: Site Restoration

TECHNICAL AREA: Contaminant Fate and Transport

TITLE: Reduction of Chlorinated Organics in Groundwater

WORK UNIT: 1900W90B

OBJECTIVE: Determine the reduction reactions for the chlorinated organic compounds trichloroethylene (TCE), perchloroethylene (PCE), and others in groundwater. Knowledge of their reduction potential can be used to evaluate remedial options for subsurface contaminant discharges. The study will provide chlorinated organic fate and persistence data which can be used to assess long-term effects in groundwater contamination situations.

APPROACH: Conduct laboratory-simulated reduction studies for chlorinated organics using aquifer material from Air Force installations. Examine factors which can effect reduction reactions in groundwater. Develop structure-reactivity relationships for reduction of chlorinated organics in groundwater.

START DATE: Oct 89 FINAL PRODUCT DUE DATE: Sep 91

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Obtain Soil and Aquifer Samples	Dec 89
2.	Preliminary Rate Constants	May 90
3.	Detailed Kinetic Studies	Apr 91
4.	Structure-Reactivity Relationships	Sep 91
5.	Technical Report	Sep 91

PROJECT OFFICER: Dr David R. Burris, RDVW, (904) 283-4297, AUTOVON 523-4297

THRUST: Site Restoration

TECHNICAL AREA: Contaminant Fate and Transport

TITLE: Contaminant Flux Reduction by Solubility Modification

WORK UNIT: 1900W90C

OBJECTIVE: Assess the feasibility of significantly reducing contaminant flux into groundwater by in situ placement of organic-rich sorbing zone downgradient of contaminant source. Organic contaminant flux reduction can lower downgradient contaminant concentrations below levels required for further remedial action.

APPROACH: Conduct laboratory experiments on processes for in situ placement of organic-rich sorbing zone. Perform detailed experiments on most promising process to determine engineering design parameters necessary for field implementation. Evaluate contaminant flux reduction potential of process.

START DATE: Oct 89 FINAL PRODUCT DUE DATE: Sep 93

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Preliminary Engineering Feasibility	Dec 89
2.	Evaluation of Possible Implacement Options	Oct 91
3.	Evaluate Flux Reduction Potential	Jun 92
4.	Design Parameters for Field Application	Sep 93

PROJECT OFFICER: Dr David R. Burris, RDVW, (904) 283-4297, AUTOVON 523-4297

THRUST: Site Restoration

TECHNICAL AREA: Contaminant Fate and Transport

TITLE: Groundwater Transport of Organic Compounds Using Box Models

WORK UNIT: 1900W90E

OBJECTIVE: Develop techniques to obtain data on transport of organic chemicals using scaled-down well fields with controllable hydrologic parameters and organic chemical solute inputs. Data from the physical box model will be used to test existing groundwater contaminant transport computer codes under various initial and boundary conditions.

APPROACH: The novelty of this approach is that computer codes will be run on data collected under controlled laboratory conditions in model aquifer boxes. Variations in flow, aquifer material heterogeneity, solute, initial and boundary conditions, aquifer material grain size, and hydraulic conductivity are practical in the model aquifer boxes so the codes can be tested. Since batch and column-based sorption coefficients do not generally agree, but differ by a nearly constant factor, comparison with box model coefficients will indicate which value is more appropriate for use in actual groundwater situations.

START DATE: Oct 88 FINAL PRODUCT DUE DATE: Dec 92

WORK CONDUCTED BY: In-house

MILESTONES:

1.	Complete Experiments with Naphthalene and Tritiated Water	May 89
2.	Analyze Data with MOC, SUTRA, and Random Walk	Oct 89
3.	Columbus AFB Aquifer Material Experiments	Oct 90
4.	Heterogeneous Aquifer Material Studies	Oct 91
5.	Column, Box, and Field Result Comparisons	Oct 92
6.	Final Report	Dec 92

PROJECT OFFICER: Dr Thomas B. Stauffer, RDVW, (904) 283-4297, AUTOVON 523-4297

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: In Situ Soil-Venting Field Demonstration Soil Venting

WORK UNIT: 21037098

OBJECTIVE: Determine the limits of JP-4 removal from soils which can be achieved in the field by soil-venting technology. The study will also develop design, cost, and operational data necessary to apply the in situ soil venting technology to other contaminated Air Force sites.

APPROACH: The approach is to design, construct, and operate a full-scale in situ soil venting system at a JP-4 spill. In situ soil venting is a soil cleanup technique which uses vacuum blowers to pull large volumes of air through contaminated soil. The air flow sweeps out the soil gas, disrupting the equilibrium existing between the contaminant adsorbed on the soil and its vapor phase. This results in further volatilization of the contaminant on the soil and subsequent removal in the air stream. In situ soil venting has been used for removing volatile contaminants such as gasoline and trichloroethylene, but a full-scale demonstration for recovering jet fuel has not been reported. Operation of a full-scale in situ soil-venting system at a 27,000-gallon JP-4 spill at Hill AFB UT began in Dec 88. At initial air flow rates of 250 cubic feet per minute, the full-scale system was removing 50 gallons per day of JP-4 from the soil. When fully operational, the venting rates will have been increased to over 1500 cubic feet per minute, which should proportionally increase JP-4 extraction rates. Operation of the in situ soil-venting system will continue until the lower limits of JP-4 removal have been reached.

START DATE: Apr 87 FINAL PRODUCT DUE DATE: Feb 90

WORK CONDUCTED BY: Oak Ridge National Laboratory
Oak Ridge TN

MILESTONES:

1.	Site Selected (Hill AFB)	Aug 87
2.	Soil Sampled	Dec 87
3.	One-Well Pilot Test	Jan 88
4.	Full-Scale Design Complete	Jun 88
5.	Construction Begins	Jul 88
6.	Operation Begins	Dec 88
7.	Test Complete	Dec 89
8.	Final Report	Feb 90

PROJECT OFFICER: 1Lt Michael E. Elliott, RDVW, (904) 283-4628, AUTOVON 523-4628

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Enhanced Biodegradation Through Soil Venting

WORK UNIT: 21037110

OBJECTIVE: Determine the impact of soil-venting operations on the biodegradation of different classes of fuel compounds. Soil venting is a relatively new method of removing volatile contaminants from the unsaturated soil zone. Soil venting introduces large volumes of air into the soil, providing oxygen needed to enhance the biodegradation of hydrocarbon contaminants. To date, the impact of soil venting on biodegradation has not been fully documented. This research will determine the extent of enhanced biodegradation occurring and develop methods for optimizing this phenomenon.

APPROACH: HQ AFESC/RDV is conducting a full-scale soil venting project at a fuel spill site at Hill AFB UT (JON: 21037098). Initial data on the impact of soil venting on biodegradation will be gathered at this site. Soil and soil-gas data will be analyzed to determine oxygen utilization and carbon dioxide production. These data will indicate the biological contribution to the reduction in fuel hydrocarbons. Laboratory and field experiments will determine the optimum conditions for enhancing biodegradation through soil venting. Special emphasis will be given to high-molecular-weight hydrocarbons, such as polyaromatics, which are not influenced by venting alone.

START DATE: Nov 88 FINAL PRODUCT DUE DATE: Dec 89

WORK TO BE CONDUCTED BY: Battelle-Columbus
Columbus OH

MILESTONES:

1.	Analysis of Hill AFB Data	Jan 89
2.	Laboratory Confirmation Studies	Apr 89
3.	Optimization Testing	Jul 89
4.	Field Testing	Sep 89
5.	Final Report	Dec 89

PROJECT OFFICER: Mr Doug Downey, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Evapotranspiration Landfill Caps

WORK UNIT: 21037111

OBJECTIVE: Demonstrate the efficacy of an innovative landfill-cover technology at an arid/semiarid site. An improved surface cover stablization technology will control erosion, deep percolation, and biological intrusion of existing and future landfills. This technology could produce substantial savings over existing landfill-cover methods in terms of installation and maintenance costs.

APPROACH: This study will apply the Los Alamos National Laboratory (LANL) landfill-cover technology to an existing Air Force site. Current EPA guidance for hazardous-waste landfills specify an elaborate system involving a liner and leachate collection and removal system. The LANL design influences the behavior of water in the top layers of the landfill cap. Most of the water infiltrating the landfill site is directed to the evapotranspiration component rather than to deteriorative processes, such as erosion or percolation. Specific design variables include the type and thickness of cover material, slope of cover surface, surface management practices, and the water-use efficiency of plant cover. The effort will study the performance of the LANL methodology against that of the current EPA liner practice with regard to cost and effectiveness.

START DATE: Feb 89 FINAL PRODUCT DUE DATE: Dec 91

WORK CONDUCTED BY: Los Alamos National Laboratory
Los Alamos NM

MILESTONES:

1.	Site Selection	Mar 89
2.	Site-Specific Design and Modeling	Jun 89
3.	Plot Construction and Instrumentation	Sep 89
4.	Water Balance Monitoring - Start	Sep 89
5.	Data Analysis	Oct 91
6.	Final Report	Dec 91

PROJECT OFFICER: 1Lt Michael E. Elliott, RDVW, (904) 283-4628, AUTOVON 523-4628

THRUST: Site Restoration

TECHNICAL AREA: Site Characterization and Investigation

TITLE: Site Characterization and Analysis Penetrometer System (SCAPS) Development

WORK UNIT: 2103VW10

OBJECTIVE: Minimize the expense of site characterization by providing an efficient tool and technique for site investigations. This will be accomplished by enhancement of the cone penetrometer's demonstrated capability to execute in situ, real-time geophysical characterization of soils. Improvements will be made by incorporating additional sensors to facilitate detection and monitoring of contaminants.

APPROACH: This three-phase study will occur over a 3-year period. Phase I will utilize existing equipment and technology to adapt the cone penetrometer into an innovative hazardous waste site characterization tool. Phase II development incorporates emerging technology to provide enhanced contaminant analysis and mapping. Phase III will verify the system's performance through demonstration for regulatory acceptance of SCAPS for site investigation and monitoring. The research will be sponsored by the three military services.

START DATE: Jan 90 FINAL PRODUCT DUE DATE: Dec 94

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Phase I - Sensor Criteria and Site Test Plans	Apr 90
2.	Field Test Reports	Dec 90
3.	Phase II - Advance Sensor and Sampler Integration	Dec 91
4.	Sensor Monitoring System Placement	Dec 92
5.	Advanced Sampling System	Dec 93
6.	Phase III - SCAPS Automation	Dec 94
7.	Final Report	Dec 94

PROJECT OFFICER: Mr Bruce J. Nielsen, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Anaerobic Biological Treatment for Remediation of Sites Contaminated by Chlorinated Compounds

WORK UNIT: 2103VW12

OBJECTIVE: Determine the effectiveness of various anaerobic biodegradation processes for treating groundwater contaminated with C_1 and C_2 chlorinated aliphatics.

APPROACH: Several anaerobic biodegradation processes have been proven to degrade C_1 and C_2 chlorinated aliphatics (for example, perchloroethylene and trichloroethylene). This effort will focus on determining the optimum conditions for chlorinated aliphatic biodegradation and identify a suitable bioreactor. Several pilot-scale (<5gpm) bioreactors will be constructed. A parametric study will be performed to determine the effects of hydraulic loading and detention time, sludge detention time, and the biological support on performance. The treatment effectiveness, ease of operation, and economics of all systems will be compared. One or two systems will then be selected and evaluated in the field.

START DATE: Oct 89 FINAL PRODUCT DUE DATE: Jan 92

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Selection Systems for Evaluations	Jan 90
2.	Construct Bioreactors	Jul 90
3.	Parametric Testing	Jul 90
4.	Determination of Treatment and Cost-Effectiveness	Aug 90
5.	Selection of System for Field Evaluation	Sep 91
6.	Final Report	Jan 92

PROJECT OFFICER: Capt Catherine M. Vogel, RDVW, (904) 283-4628, AUTOVON 523-4628

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Field Demonstration of Crossflow Air Stripping with Catalytic Oxidation

WORK UNIT: 2103VW13

OBJECTIVE: Field demonstrate crossflow air stripping and catalytic oxidation as cost-effective treatment technologies for cleanup of fuel-contaminated groundwater. Crossflow air stripping has been shown in the laboratory and in pilot tests to be an efficient and cost-effective technique for removing volatile organic compounds (VOCs) from groundwater. Catalytic oxidation has also been tested and showed a tremendous ability to reduce the energy requirements necessary to destroy VOCs in the emissions of air stripping towers. These two technologies will be field-tested together to demonstrate their capabilities and cost effectiveness.

APPROACH: The approach is to field-demonstrate an innovative air-stripping treatment technique, called crossflow air stripping, in conjunction with a catalytic oxidation unit for emissions control. Crossflow air stripping involves changing the internal configuration of a conventional countercurrent packed tower. The change dramatically reduces the operating pressure drop without reducing stripping efficiency. The main change is the placement of baffles inside the tower which causes the air to flow in a crisscross pattern up through the packing. This forces the air to flow at 90 degrees to the flow of contaminated water rather than in completely opposing directions as in a countercurrent tower. Pressure measurements on a laboratory crossflow tower were ten times lower than a conventional countercurrent tower. For catalytic oxidation, the approach is to field-test new catalysts which have slow deactivation rates and lower temperatures for oxidation.

START DATE: May 90 FINAL PRODUCT DUE DATE: May 92

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	System Design	Dec 90
2.	Field Tests	Dec 91
3.	Final Report	May 92

PROJECT OFFICER: 1Lt Michael G. Elliott, RDVW, (904) 283-4628, AUTOVON 523-4628

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Air Stripping Contaminated Air Force Groundwater

WORK UNIT: 2103VW21

OBJECTIVE: Establish an air-stripping and emissions control design database specific to contaminants of Air Force concern.

APPROACH: Three groundwater streams, representing the contamination at most Air Force bases, will be studied. One waste stream will contain jet fuel components, a second waste stream will contain solvents, and the third waste stream will contain a mixture of fuels and solvents. Testing will include studies to determine the effect of mixtures on stripping efficiency, cost-effectiveness of new packings, mass transfer, pressure drop relationships in rotary air stripping, and effectiveness of new oxidation catalysts.

START DATE: Sep 89 FINAL PRODUCT DUE DATE: Oct 92

WORK CONDUCTED BY: *To be determined*

MILESTONES:

1.	Task Award	Sep 89
2.	Mixture Interactions	Jan 90
3.	Air-Stripping Database	Jan 91
4.	Mass Transfer Relationships	Aug 92
5.	Catalytic Oxidation	Oct 92

PROJECT OFFICER: 1Lt Michael G. Elliott, RDVW, (904) 283-4628, AUTOVON 523-4628

THRUST: Site Restoration

TECHNICAL AREA: Contaminant Fate and Transport

TITLE: Groundwater Solute Model Optimization

WORK UNIT: 2103W90D

OBJECTIVE: Identify, optimize, and field test groundwater transport models to standardize the Air Force approach to environmental impact assessment of groundwater for both cost reduction and efficiency. More accurate assessments of groundwater contamination will allow optimum design of remedial action, based on a rational method of problem definition.

APPROACH: Most groundwater modeling work has been done at the research level with limited field validation. Typically, contractors research and apply appropriate models or develop new models applying only to one site. Little field data exist to validate these models, limiting their value as an impact assessment tool. This effort will concentrate on identifying standardized modeling approaches to be applied to a wide variety of applications. User-friendly interfaces on standard computer systems, with well documented guidance, will be developed. The system will be validated and refined, using existing Installation Restoration Program data. The models will more accurately determine extent and impact of contamination and guide further data collection to predict the efficiency of remedial action alternatives.

START DATE: Oct 89 FINAL PRODUCT DUE DATE: Sep 93

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Literature Review	Jan 90
2.	Model Selection	Aug 90
3.	Model Testing	Mar 91
4.	Field Validation	Mar 93
5.	Final Report	Sep 93

PROJECT OFFICER: Maj Michael L. Shelley, RDVC, (904) 283-2097, AUTOVON 523-2097

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Air Stripping with Emissions Control

WORK UNIT: 37883063

OBJECTIVE: Field test alternative air-stripping techniques and materials, including emission control, and provide performance data required for full-scale development.

APPROACH: The demonstrations will be performed at Eglin Air Force Base on a site with groundwater contaminated by JP-4. Two air-stripping and two emission-control technologies will be evaluated. The air-stripping techniques will be rotary air stripping (RAS) and a conventional packed-column, countercurrent air stripper (CCAS) packed with novel packings. The emissions-control techniques will be sorption (carbon and a synthetic material) and catalytic destruction. Testing will be conducted over a wide range of operating conditions enabling the design of small (<30 gpm), and larger treatment systems (>100 gpm).

START DATE: Feb 87 FINAL PRODUCT DUE DATE: Dec 89

WORK CONDUCTED BY: Oak Ridge National Laboratory
Oak Ridge TN

MILESTONES:

1.	Literature Review	Jan 88
2.	Site Selection	Mar 88
3.	Equipment Procurement	Jul 88
4.	Operational Testing	Jun 89
5.	Final Report	Dec 89

PROJECT OFFICER: 1Lt Mike Elliott, RDVW, (904) 283-4628, AUTOVON 523-4628

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Full-Scale Radio-Frequency Soil Decontamination

WORK UNIT: 37883073

OBJECTIVE: Demonstrate the feasibility of full-scale radio frequency soil heating to distill and volatilize hazardous organic chemicals from the soil. The concept of radio frequency decontamination has been proven in a pilot-scale test at Volk Field ANGB WI. In this test, over 95 percent of the fuel and oil residuals were removed from soils in an abandoned fire training area. The RF unit will now be optimized to improve soil gas collection, vapor treatment, and reduce operation costs to less than $100 per-cubic-yard. Assuming a successful full-scale test, this technology will be ready for commercialization in 1990.

APPROACH: This project began in 1985 as an EPA/HWERL cooperative agreement with the Illinois Institute of Technology (IIT) Research Institute to study the use of radio frequency heating as catalyst to chemical decontamination methods. This effort is a follow-on to JON 21037099, which successfully demonstrated the radio frequency (RF) method in 500 cubic feet of fuel contaminated soil. This project will optimize the RF system through improvements to soil gas collection, vapor treatment, and energy efficiency. Following optimization and full-scale design, a full-scale demonstration will be conducted at a contaminated Air Force site.

START DATE: Oct 88 FINAL PRODUCT DUE DATE: Dec 90

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Complete Optimized Design	Oct 89
2.	Begin Full-Scale Testing	Apr 90
3.	Complete Full-Scale Testing	Aug 90
4.	Full-Scale Commercialization	Dec 90
5.	Final Report	Dec 90

PROJECT OFFICER: Mr Doug Downey, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Site Restoration

TECHNICAL AREA: Remedial Action Technologies

TITLE: Treatment of Chlorinated Organics with Aboveground Bioreactors

WORK UNIT: 3788VW17

OBJECTIVE: Identify the trichloroethylene (TCE) biodegradation process best suited for Air Force needs and determine the design and operational parameters needed to construct a bioreactor for groundwater cleanup.

APPROACH: Bioremediation vendors will be contacted and at least two commercial systems will be selected for pilot-scale demonstrations at an Air Force site. Laboratory tests will be performed on the methane-utilizing system to complete performance optimization. All pilot-scale (<5gpm) bioreactors selected will undergo prescreening laboratory tests followed by field evaluation. Following the field evaluation, the cost and treatment effectiveness of each process will be evaluated and a system will be selected for full-scale development and testing.

START DATE: May 90 FINAL PRODUCT DUE DATE: Jun 92

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Site Selection	May 90
2.	Laboratory Tests	Sep 90
3.	Prescreening	May 91
4.	Field Testing	Oct 91
5.	System Selection	Jan 92
6.	Final Report	Jun 92

PROJECT OFFICER: Capt Catherine Vogel, RDVW, (904) 283-4628, AUTOVON 523-4628

THRUST: Site Restoration

TECHNICAL AREA: Site Characterization and Investigation

TITLE: Improved Methods for Monitoring Fuel Biodegradation

WORK UNIT: 3788VW18

OBJECTIVE: A sampling and analytical procedure will be developed that can determine the rate of in situ biodegradation occurring at JP-4 spill sites. This procedure will be used to predict the natural biodegradation potential of spills which receive no remediation and to monitor the progress of enhanced biodegradation projects. Problems with measuring in situ biodegradation have been documented by EPA and HQ AFESC researchers conducting enhanced biodegradation field studies.

APPROACH: This project will first review soil and groundwater data from fuel-contaminated sites and identify those sampling and analytical methods which could provide useful information on in situ biodegradation rates. A series of column studies will be conducted to correlate various indicators of biodegradation and to develop a sampling and analysis protocol which will predict the rate of biodegradation under both enhanced and national conditions. Field verification of these methods will follow at a fuel spill site.

START DATE: Dec 89 FINAL PRODUCT DUE DATE: Nov 91

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Literature Review	Feb 90
2.	Initiate Laboratory Tests	Jun 90
3.	Correlation Development	Dec 90
4.	Field Monitoring Test	May 91
5.	Final Report	Nov 91

PROJECT OFFICER: Mr Doug Downey, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Environmental Compliance

TECHNICAL AREA: Environmental Impact Assessment

TITLE: Interaction Between Surfaces and Air Oxidation of Hydrazines

WORK UNIT: 01008314

OBJECTIVE: To determine the air oxidation rate, kinetics, and mechanisms of hydrazine fuels as a function of the composition and area of different surfaces with which they may come in contact. The research will also be aimed at determining the molecular interactions responsible for any observed chemical transformations. The results will provide technical data for improved spill treatment methods and enhanced atmospheric dispersion models.

APPROACH: Fourier transform infrared (FTIR) spectroscopy will be used to follow the course of the reactions in situ. The former Teflon* film reaction chamber has been replaced with a Teflon*-coated stainless steel spherical reaction chamber to facilitate much more complete control over experimental conditions. The new chamber has a large access port which allows different surfaces to be introduced so that their influence on the autoxidation kinetics of hydrazine fuels can be directly measured.

START DATE: Oct 86 FINAL PRODUCT DUE DATE: Sep 90

WORK CONDUCTED BY: In-house

MILESTONES:

1.	Completion of Studies in Teflon* Film-Reaction Chamber	Feb 87
2.	Technical Report - Journal Publication	Jan 88
3.	Hydrazine Air Oxidation Studies - Metal Chamber	Dec 89
4.	Technical Report - Journal Publication	Mar 90
5.	Monomethyl Hydrazine and Unsymmetrical Dimethyl Hydrazine Air Oxidation Studies - Metal Chamber	May 90
6.	Final Report	Sep 90

PROJECT OFFICER: Dr Daniel A. Stone, RDVS, (904) 283-4298, AUTOVON 523-4298

THRUST: Environmental Compliance

TECHNICAL AREA: Environmental Impact Assessment

TITLE: Atmospheric Chemistry of VOCs

WORK UNIT: 01008324

OBJECTIVE: Determine the mechanisms and products of the reactions which occur between VOCs and reactive trace chemical species in the atmosphere. These reactions have the potential to produce ozone and other toxic products. This effort will provide a technical base which will greatly enhance our understanding of the fundamental interactions which control the fate and effects of VOCs from Air Force installations. These studies will ultimately prevent overrestrictive and costly vapor control and recovery hardware from being unnecessarily installed.

APPROACH: A specially constructed Teflon* film reaction chamber will be used for this project. It will have a volume of about 4,000 liters and be surrounded by banks of ultraviolet lamps to simulate sunshine. Inside the chamber, a set of mirrors will be mounted to provide long-path infrared monitoring of the reactions that occur. This analytical technique will identify, quantitate, and chart the concentrations of key chemical intermediates and reaction products as a function of time. Specific VOCs will be characterized as to their potential for adverse atmospheric impact.

START DATE: Mar 88 FINAL PRODUCT DUE DATE: May 92

WORK CONDUCTED BY: In-house

MILESTONES:

1.	Literature Review	Mar 90
2.	Chamber Construction	Apr 90
3.	Conditioning and Characterization Experiments	Jun 90
4.	Photochemical Experiments	Dec 91
5.	Final Report	May 92

PROJECT OFFICER: Dr Daniel A. Stone, RDVS, (904) 283-4298, AUTOVON 523-4298

THRUST: Environmental Compliance

TECHNICAL AREA: Environmental Impact Assessment

TITLE: Environmental Interactions of Hydrazine Fuels

WORK UNIT: 19002073

OBJECTIVE: To provide further chemical insight and knowledge concerning the atmospheric reactions of hydrazine-based fuels. This includes further research into the mechanisms, rates, products, role of surfaces, and related areas of the reactions of hydrazine-based fuels in the atmosphere. Previous studies have left a number of important questions remain which will be addressed in this project, including: (1) What are the chemical intermediates involved? (2) What is the role of surfaces? (3) What type of chemical behavior would actually be observed in an outdoor release of these fuels? and, (4) What are the mechanisms of these reactions? In addition, this project will address the question of the effectiveness of kaolin-type material for the treatment of hydrazine fuel spills.

APPROACH: The study will include hydrazine fuels and structurally similar chemicals to elucidate the actual mechanisms of the reactions which are occurring. Apparatus specifically designed to observe transients will aid in their identification and help determine their mechanistic role. This same apparatus will enable fast reactions to be monitored. Chamber studies in combination with diffuse reflectance and catalyst decomposition experiments will be conducted to observe and characterize the role of surfaces in air oxidation processes and the effectiveness of kaolin-treatment materials.

START DATE: Jan 85 FINAL PRODUCT DUE DATE: Dec 89

WORK CONDUCTED BY: NASA White Sands Test Facility
White Sands NM

MILESTONES:

1.	Surface Chemical Reactions	Jan 86
2.	Environmental Chamber Studies	Jun 87
3.	Laminar Flow Reactor Studies	May 89
4.	Kaolin Clay Effectiveness Characterization	Sep 89
5.	Final Report	Dec 89

PROJECT OFFICER: Dr Daniel A. Stone, RDVS, (904) 283-4298, AUTOVON 523-4298

THRUST: Environmental Compliance

TECHNICAL AREA: Environmental Impact Assessment

TITLE: Aircraft Engine-Emissions Model for Low-Altitude Flight Operations

WORK UNIT: 19002098

OBJECTIVE: Develop an atmospheric dispersion model specifically designed to predict air pollutant concentrations from aircraft flying at low level. This work is in support of the Generic Environmental Impact Statement effort being managed by AFRCE-BMS. Analysis of the visibility impact of aircraft emissions at low altitudes will also be done under this effort.

APPROACH: Suitable atmospheric dispersion models will be selected for modification. These models will be modified to accurately predict air quality impacts from low-level flight of aircraft along military training routes and military operations areas. Recently developed aircraft emissions databases will be incorporated into the model to provide emissions source information. A field study will be conducted to assess visibility impacts of low-altitude flight operations.

START DATE: Sep 88 FINAL PRODUCT DUE DATE: Apr 90

WORK CONDUCTED BY: Oak Ridge National Laboratory
Oak Ridge TN

MILESTONES:

1.	Model Selection	Jul 88
2.	Model Modification	Nov 89
3.	Model Evaluation	May 89
4.	Model Demonstration	Sep 89
5.	Final Report	Apr 90

PROJECT OFFICER: Capt Wayne P. Chepren, RDVS. (904) 283-4234; AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Environmental Impact Assessment

TITLE: Spectroscopic Studies of Interactions Between Fuel Aromatic Compounds and Soils

WORK UNIT: 19002099

OBJECTIVE: Determine the molecular interactions which control the ultimate fate of aromatic fuel components in soils and aquifers. These studies will also include the development of specific techniques and protocols for using state-of-the-art spectroscopic instruments to probe and characterize these interactions. These studies will support macroscopic batch isotherm techniques by providing detailed information on the mechanisms by which this class of chemicals interacts with the surfaces of soil particles.

APPROACH: Studies of the interactions of chemicals with soils have been traditionally approached with macroscopic batch isotherm techniques. These techniques are essential to understanding bulk soil properties but give no direct information about adsorption mechanisms or interactions. This project will use vibrational spectroscopy (both infrared and Raman), selectively coupled with matrix isolation techniques, to characterize the molecular-level interactions which ultimately control the fate of aromatic chemicals in soils. Experiments will begin with simple, unperturbed reference spectra. Once the spectroscopic characteristics of specific isolated species are determined, the significant spectral changes which occur through interactions of these species with various soil types can be interpreted in terms of chemical mechanisms.

START DATE: Aug 88 FINAL PRODUCT DUE DATE: Sep 90

WORK CONDUCTED BY: University of Florida
Gainesville FL

MILESTONES:

1.	Obtain and Prepare Standard Clay Minerals	Dec 88
2.	Technique Development - FT Raman and Matrix Isolation	Mar 89
3.	Collect Reference Spectra	Jun 89
4.	Conduct Spectroscopic Structure Stability Studies	May 90
5.	Conduct Matrix Isolation Studies	Jun 90
6.	Final Report	Sep 90

PROJECT OFFICER: Dr Daniel A. Stone, RDVS, (904) 283-4298, AUTOVON 523-4298

THRUST: Environmental Compliance

TECHNICAL AREA: Environmental Impact Assessment

TITLE: Application of Pattern Recognition Techniques to Problems in Advanced Pollution Monitoring

WORK UNIT: 19002102

OBJECTIVE: Develop an advanced and modern chemical pattern recognition system which will be easy to use and capable of accurately recognizing fuel chromatographic profiles. The system will address situations where two or more dissimilar fuels have leaked and have formed a mixed plume of contaminants. The system will also provide graphic displays of the fuel profile database and the data structure.

APPROACH: This pattern recognition system will be based on an advanced algorithm called the Fuzzy-C Variety Method. This method will form a principal components model of each type of fuel and will use concepts from fuzzy set theory to assign class memberships to samples of unknown fuels. The computer program package will also graphically illustrate the data space models using false color visualization of fuel categories. One level of the computer programs will be versatile enough to be used in research laboratories classifying fuels and other environmental mixtures. Another level of these computer programs will be equipped with a simplified user interface to permit their use by personnel who are not pattern recognition experts. This will permit production laboratory chemists to assign fuel classifications based on chromatograms of spilled fuels.

START DATE: Jun 89 FINAL PRODUCT DUE DATE: Jul 91

WORK CONDUCTED BY: Clarkson University
Potsdam NY

MILESTONES:

1.	First Prototype Developed	Apr 89
2.	Monte Carlo Simulations on Prototype	Jan 89
3.	Evaluations With Jet Fuel Chromatographic Data	Jul 90
4.	Final Product Developed	Feb 90
5.	Final Program Tested for Accuracy	Apr 90
6.	Final Report	Jul 91

PROJECT OFFICER: Dr Howard Mayfield, RDVC, (904) 283-4298, AUTOVON 523-4298

THRUST: Environmental Compliance

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Catchment and Separation of Depleted Uranium Projectiles

WORK UNIT: 19007037

OBJECTIVE: The purpose of this project is to develop environmentally acceptable catchment and separation technologies for 30 mm depleted uranium projectiles test fired into target butts. Development of a satisfactory catchment and separation technique could significantly reduce the disposal costs associated with low-level radioactive wastes.

APPROACH: The study includes a literature search and process separation testing for sand-based catchment systems and a concept evaluation directed at alternative media catchment systems.

START DATE: Apr 88 FINAL PRODUCT DUE DATE: Mar 91

WORK CONDUCTED BY: Oak Ridge National Laboratory
Oak Ridge TN

MILESTONES:

1.	Literature Study	Jul 88
2.	Sample Analysis	Aug 88
3.	Catchment System Concept Evaluation	Feb 89
4.	Interim Report Number 1	Feb 89
5.	Bench-Scale Separation Testing	Mar 89
6.	Interim Report Number 2	May 89
7.	Pilot-Scale Testing and Design	Sep 90
8.	Final Report	Mar 91

PROJECT OFFICER: Capt Helen Williams, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Pollution Control

TITLE: Flow-Tube Combustor for Hypergol Destruction

WORK UNIT: 19007044

OBJECTIVE: The current climate of escalating environmental regulations has created a need for methods that effect total and final destruction of energetic nitrogenous materials (hydrazines and nitrogen tetroxide) under conditions that release the smallest attainable amounts of polluting products of destruction. Although the exothermicity of the hypergolic materials strongly favors combustion as a means of destruction, exhaust streams from prototype incinerators contain concentrations of pollutant oxides of nitrogen (NO_x) that would be unacceptable to regulatory agencies.

APPROACH: Phase I of this effort will be the development and implementation of coherent anti-Stokes Raman spectroscopic and molecular beam mass spectrometric diagnostic devices into a variable-pressure, flow-tube combustor. This combustor will be used to determine accurate rate constants for bimolecular reactions between the species formed during combustion of materials containing the elements C, H, O, and N. After experimental determination of the relationship of operating conditions to efficiency of destruction of feed material and to rates of formation and destruction of NO_x in a flow tube, a Phase II burner will be designed on this principle that will monitor operating parameters and index concentrations at critical sites within the combustion train and employ this information continuously to reoptimize the combustion process. Reduction of most of the NO_x in the exhaust stream will be accomplished in a second combustion stage, based on Exxon's proven Thermal DeNO_x process, which introduces ammonia into the exhaust stream at a regulated temperature. Scale-up of the prototype burner developed will be a Phase III effort sponsored by Space Division.

START DATE: Apr 87 FINAL PRODUCT DUE DATE: Sep 92

WORK CONDUCTED BY: Aerospace Corporation
Los Angeles CA

MILESTONES:

1.	Determine Diagnostics to be Used in Design	Jul 87
2.	Construct Variable-Pressure Flow Tube	Sep 89
3.	Rate Constant Data from Flow Tube	Jun 90
4.	Phase I - Final Report	Sep 90
5.	Construct Atmospheric Pressure Flow Tube	Jan 91
6.	Refine Existing Combustion Model	Jan 92
7.	Design for Full-Scale Flow Tube	Sep 92
8.	Phase II - Final Report	Sep 92

PROJECT OFFICER: Dr Joseph D. Wander, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Minimization of Hazardous Wastes from Manufacture of Glycidyl Azide Polymer

WORK UNIT: 19007046

OBJECTIVE: Glycidyl azide polymer (GAP) is an inhomogeneous, prepolymeric material that is under development as a reactive binder in low-signature, high-energy propellants and in insensitive explosives. Current projections call for annual production of hundreds of tons of GAP by 1990 at a cost of $20 per pound; however, current manufacturing practice generates hazardous wastes requiring disposal at costs exceeding $50 per pound of GAP produced. The purpose of this project is to develop modifications to the work-up that will decrease the unit cost of product by decreasing the amount and toxicity of the wastes and byproducts associated with the manufacture of GAP.

APPROACH: The manufacturing process has been optimized for yield and quality of GAP, without regard to waste generated. Operating parameters in the steps of the existing process will be adjusted to decrease waste generation and to increase ease of recoverability of materials in waste streams. Concurrently, graduated additions of wastes to the filtered reaction mixture will be made to precipitate fractions of crude GAP. The best features from both investigations will be assembled into an optimized process design. The approved design will be implemented on a small pilot-scale for demonstration, whereas scalability will be justified by precedents and/or calculations.

START DATE: Aug 88 FINAL PRODUCT DUE DATE: Apr 90

WORK CONDUCTED BY: 3M Corporation
St Paul MN

MILESTONES:

1.	Lab-Scale Testing of Process Modifications	May 89
2.	Pilot-Plant Demonstration of Optimized Process	Oct 89
3.	Evaluation of Product-GAP Properties	Feb 90
4.	Final Report	Apr 90

PROJECT OFFICER: Dr Joseph D. Wander, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Pollution Control

TITLE: Supercritical Fluid Oxidation of Hazardous Wastes

WORK UNIT: 19007053

OBJECTIVE: Regulatory disallowance of open burning and open detonation will create an acute need for inexpensive, safe, nonpolluting methods of disposing of energetic materials. The high energy content of propellants and explosives suggests combustion methods, but combustion in air produces polluting byproducts. Supercritical oxidation (SCO) has been shown to be a safe, nonpolluting, but marginally cost-effective method of destroying common wastes. This project will determine the benefits and liabilities of SCO as a method for disposing of energetic materials.

APPROACH: Bench-scale quantities of 10 pure materials (ammonium perchlorate [AP], 1,2,4-butanetriol trinitrate [BTTN], glycidyl azide polymer [GAP], nitrocellulose [NC], nitroglycerin [NG], nitrogen tetroxide [N_2O_4], pentaerythritol tetranitrate [PETN], cyclotrimethylene trinitramine [RDX], 2,4,6-trinitrotoluene [TNT], and 1,1-dimethylhydrazine [UDMH]) will be dissolved or slurried in water or dissolved in an organic solvent. The liquid or slurry will be pumped into a high-pressure chamber, heated above the critical temperature of water, and homogeneously oxidized. Conditions during each experiment and products of each experiment will be reported, together with an extrapolation to bulk scale of the efficacy and safety of SCO treatment of each of these materials. Subsequent phased efforts will extend the treatment to explosive and propellant compositions and to plant scale.

START DATE: Feb 89 FINAL PRODUCT DUE DATE: Jan 92

WORK CONDUCTED BY: Los Alamos National Laboratory
Los Alamos NM

MILESTONES:

1.	Define Standard Operating Procedure and File Compliance Actions	May 89
2.	Build Flow Reactors	Aug 89
3.	Initial Survey of Kinetics and Products	Jul 90
4.	Tests with Cofuels and Moderators	Jan 91
5.	Preliminary Engineering Report	Apr 91
6.	Pilot-Plant Design	May 92
7.	Final Report	Jan 92

PROJECT OFFICER: Dr Joseph D. Wander, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Pollution Control

TITLE: Reduction of NO_x in Jet Engine Test Cells

WORK UNIT: 19007054

OBJECTIVE: Evaluate the effectiveness of photopromoted catalysts for controlling NO_x emissions from jet engine test cells. Most NO_x control technologies rely on the chemical reduction of NO_x into N_2 and O_2. Reduction requires catalysts and chemical additives, some of which are extremely toxic or pollutants themselves. Photopromoted catalysts are capable of decomposing NO_x without additives. Light is provided at wavelengths absorbed by the catalyst. This light activates sites on the surface of the catalyst which promote NO_x decomposition.

APPROACH: One or more catalysts and sets of conditions which result in decomposition to N_2 and O_2 of at least 90 percent of the NO initially supplied in the gas stream, with a contact time of not more than one second, will first be identified. Performance characteristics of the decomposition process will then be improved to a level suitable for subsequent development of a NO_x-control device for jet engine test cells.

START DATE: Sep 89 FINAL PRODUCT DUE DATE: Sep 92

WORK CONDUCTED BY: *Synlize, Inc.*
Brookline MA

MILESTONES:

1.	Select Known Catalysts	Jan 90
2.	Measure Performance	Jan 91
3.	Process Improvement Studies	Jul 91
4.	Process Suitable for Jet Engine Test Cell	Apr 92
5.	Final Report	Sep 92

PROJECT OFFICER: Capt Wayne Chepren, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Pollution Control

TITLE: Study of NO_x Formation and Control in a Gas Turbine Combustor

WORK UNIT: 19007055

OBJECTIVE: A set of design criteria and numerical models for the design of a low-NO_x combustor will be developed. The chemistry of NO_x formation is well understood, but no work has been done to understand how this chemistry interacts with the complex aerodynamics of jet engine combustors. A NO_x-reduction design database for combustors will allow control of NO_x emissions to be considered along with engine performance in the design of future jet engines.

APPROACH: A laboratory gas-turbine combustor, designed in cooperation with jet engine manufacturers to represent combustors found in today's jet engines will be used. Nonintrusive laser diagnostic techniques for measuring the combustor's internal velocity, pressure, and thermal fields, as well as new probe sampling techniques for measuring combustion species concentrations, will be used to study NO_x formation. Development of a new coherent anti-Stokes Raman spectroscopy (CARS) system designed to nonintrusively measure NO_x, N_2, and O_2 concentrations, will also be completed for this study.

START DATE: Sep 89 FINAL PRODUCT DUE DATE: Sep 92

WORK CONDUCTED BY: Mechanical Engineering Department
University of California
Irvine CA

MILESTONES:

1.	Incorporate Diagnostic Enhancements	Oct 90
2.	Numerical Modeling Enhancements	Apr 90
3.	CARS Measurement of NO_x Fields	Jan 91
4.	High Pressure Measurements	Apr 92
5.	Final Report	Sep 92

PROJECT OFFICER: Capt Wayne Chepren, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Corrosion Inhibitor Technology

WORK UNIT: 19007057

OBJECTIVE: Develop a method to minimize hazardous waste produced by painting and depainting operations at the Air Logistics Centers. The use of chromate corrosion inhibitors in paints and anticorrosion coatings by DOD has been restricted to those systems for which substitute, nonchromate inhibitors are either unavailable or ineffective. The development of corrosion inhibitors for DOD paints has followed the application of inorganic solids. The application of organic anticorrosion agents has been limited to direct contact with the metal parts to be protected. Currently, there are no nonchromate inhibitors for coating aluminum with primers on top coats. No alternative for paints and other coatings for aluminum presently exists that does not contain a chromate. The result is the generation of large quantities of hazardous wastes for painting and paint stripping operations.

APPROACH: Modifications in corrosion inhibitor technology have been investigated. The formulation of organic inhibitors in paints will be feasible when the inhibitors are microencapsulated. Conventional encapsulation technology will be applied and the release of the inhibitor will be controlled by shell thickness and diffusivity. A comparison will be made of the activity of a nitrate quaternary ammonia inhibitor salt which has been microencapsulated to a known CR (VI) corrosion inhibitor. If successful, the product will then be tested in a formulation with an epoxy polyamide primer which contains no chromate inhibitors. This work will be conducted under Broad Agency Announcement No. 89-02.

START DATE: Oct 89 FINAL PRODUCT DUE DATE: Sep 91

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Selection and Testing of Inhibitors	Mar 89
2.	Perform Electrochemical Evaluation	Jun 89
3.	Microencapsulate Inhibitors	Dec 90
4.	Deactivate Microcapsule Surfaces	Jun 90
5.	Formulate in Epoxy Polymide Primer	Apr 91
6.	Test Nonchromate Epoxy Primers	Jun 91
7.	Final Report	Sep 91

PROJECT OFFICER: Mr Charles Carpenter, RDVS, (904) 283-2942, AUTOVON 523-2942

THRUST: Environmental Compliance

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Validation of Metals Recovery Technology

WORK UNIT: 19007058

OBJECTIVE: Develop a method to minimize hazardous waste produced by the electroplating shops of the Air Logistics Centers (ALCs) by reducing or eliminating the production of hazardous sludge from metals treatment operations. Conventional metals treatments and clarification processes result in large quantities of hazardous sludges that must be disposed of as hazardous waste. It is usually shipped to a landfill at an exorbitant price ($220 per ton). On the other hand, Robins AFB has stockpiled their sludge for the past ten years in a specially prepared building. Both methods are costly and result in the possibility of future liabilities.

APPROACH: The project will develop technology to remove heavy metals from the sulfide sludges. This research will use smelting, solvent extraction, and/or chemical precipitation processes to recover metals from sludges and allow the biodegradation and/or delisting of those sludges. The Air Force Engineering Services Center has recently developed a ferrous sulfate/sodium sulfide method of treating industrial wastewater for heavy metals, producing a sulfide sludge for which this technology would be extremely applicable. Recent literature on techniques used in the mining industry shows successful extraction of metals from sulfide ores. This suggests that those techniques will work on chemically similar sludges generated at facilities using a sulfide precipitation process. The project will demonstrate the feasibility and economic and environmental benefits of a closed loop metal recovery metals treatment process and provide a design for a pilot-scale study. This will be accomplished through DOE contract.

START DATE: Oct 89 FINAL PRODUCT DUE DATE: Sep 90

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Preliminary Economics	May 89
2.	Physical Characterization of the Sludge	Jun 89
3.	Laboratory Studies of Smelting	Jun 89
4.	Biosolubility Studies	Jul 89
5.	Chemical Studies	Sep 89
6.	Phase II - Design of Pilot-Scale System	Sep 90
7.	Technical Report	Sep 90

PROJECT OFFICER: Mr Charles Carpenter, RDVS, (904) 283-2942, AUTOVON 523-2942

THRUST: Environmental Compliance

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Nonhazardous Inhibitors and Additives for Solvents

WORK UNIT: 19007061

OBJECTIVE: Develop less toxic and safer additives for chlorinated solvents to maximize useful life of vapor degreasing solvents.

APPROACH: The contractor will identify nontoxic inhibitors as substitutes for currently used antioxidants, metal stablilizer, and acid acceptor additives. Chlorinated solvents with nontoxic additives will be tested on metal coupons and aircraft parts soiled with dirt, grease, wax, and lubricants. These tests will be conducted in a laboratory-scale vapor degreaser. Optimum inhibitor packages will be selected, based on cleaning efficiency, increased useful life of the solvent, and safer working environments for Air Force solvent bath operators.

START DATE: Jun 89 FINAL PRODUCT DUE DATE: Sep 91

WORK CONDUCTED BY: Auburn University
Auburn AL

MILESTONES:

1.	Selection of Nontoxic Additives for Testing	Aug 89
2.	Laboratory Tests on Metal Coupons	Mar 90
3.	Selection of Optimum Additive Package for Pilot Test	Jun 90
4.	Conduct a Pilot Test on Soiled Aircraft Parts	Mar 91
5.	Final Report	Sep 91

PROJECT OFFICER: Mr Surendra B. Joshi, RDVS, (904) 283-4235, AUTOVON 523-4235

THRUST: Environmental Compliance

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Treatment of Firefighter Training Facilities (FTF) Wastewaters

WORK UNIT: 19007062

OBJECTIVE: To determine methods to treat FTF wastewaters containing fuel components, fire extinguishing agents, and combustion products. Evaluate alternative treatment strategies to various site conditions and wastewater discharge requirements.

APPROACH: The approach is a three-phase study. Phase I will characterize the wastewater and determine the effects of changing the user-controlled operating conditions. The study will utilize the Engineering and Services Center's concept prototype FTF. This FTF is a generic design to be used throughout the Air Force. Phase II will be an evaluation of the data to report on environmental effects of changing user-controlled operating conditions and bench-scale test various treatment technologies on actual firefighting wastewaters. Phase III will be the validation of operating modifications and treatment technologies from Phase II in the field.

START DATE: Jan 90 FINAL PRODUCT DUE DATE: Jan 93

WORK CONDUCTED BY: In-house

MILESTONES:

1.	Phase I - Completed - Wastewater Characterization	Jan 91
2.	Phase II - Completed - Bench-Scale Treatment Tests	Jan 92
3.	Phase III - Completed - Field Validation	Aug 92
4.	Final Report	Mar 93

PROJECT OFFICER: 1Lt Edward G. Marchand, RDVW, (904) 283-2942, AUTOVON 523-2942

THRUST: Environmental Compliance

TECHNICAL AREA: Pollution Control

TITLE: NO_x Reduction Technology

WORK UNIT: 1900VS17

OBJECTIVE: Regulatory limits on NO_x emissions from jet engine test cells (JETCs) may be expected to impact significantly on the operation of these facilities. The environment in a JETC is hostile to most NO_x control methods because the temperatures are high, the exhaust flow rate is large and highly variable, and soot particles are present in significant amounts. A number of technologies have demonstrated promise in application to NO_x emissions from less hostile sources. The objective of this project is to evaluate potential NO_x control technologies in a range of environments representative of the extremes of conditions encountered in JETCs.

APPROACH: Bench-scale reactors will be designed and built to permit treatment of exhaust streams or surrogates under controlled temperatures and flow rates. Several technologies (to be determined) will be examined in this effort, which will include measurement of NO_x in the feed to the reactor and in the exhaust. Variables will include the temperature and particulate density of the feed stream. Evaluation will include both the treatment and necessary pretreatments.

START DATE: Oct 89 FINAL PRODUCT DUE DATE: Sep 91

WORK CONDUCTED BY: In-house

MILESTONES:

1.	Selection of Technologies for Evaluation	Feb 90
2.	Design and Construction of Reactor I	May 90
3.	Design and Construction of Reactor II	Sep 90
4.	Design and Construction of Reactor III	Feb 91
5.	Final Report	Sep 91

PROJECT OFFICER: Dr Joseph D. Wander, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Site Restoration

TECHNICAL AREA: Environmental Impact Assessment

TITLE: Environmental Fate and Effects of JP-8

WORK UNIT: 1900VS21

OBJECTIVE: Determine the interactions of the hydrocarbon fuel JP-8 with the environment. This will include a characterization of the fuel, a study of its variability, its physical and biological degradation, and its environmental transport.

APPROACH: Gas chromatography and gas chromatography/mass spectrometry will be used to analyze the total fuel, its water soluble fraction, and its easily volatilized fraction. Component concentrations and variabilities will be measured. Biodegradation will be measured in aqueous media and will be compared with biodegradation studies made previously for JP-4. Fuel evaporation and breakdown by physical processes will be measured. Transport of the water soluble components of the fuel by groundwater will be simulated in the laboratory using aquifer material samples. Where possible, JP-8 data will be compared with previous measurements made with JP-4.

START DATE: Jun 89 FINAL PRODUCT DUE DATE: Nov 92

WORK CONDUCTED BY: In-house

MILESTONES:

1.	Complete Project Work Plan	Jul 89
2.	Perform Biodegradation Experiments	Aug 89
3.	Collect Fuel Samples	Dec 89
4.	Analyze Neat Fuel Samples	Dec 90
5.	Analyze Water Soluble Fractions	Dec 90
6.	Conduct Water Soluble Transport Trials	Jul 92
7.	Final Report	Nov 92

PROJECT OFFICER: Mr Howard T. Mayfield, RDVC, (904) 283-4298, AUTOVON 523-4298

THRUST: Environmental Compliance

TECHNICAL AREA: Pollution Control

TITLE: Prototype Volatile Organic Compound (VOC) Monitor Phase II

WORK UNIT: 21032011

OBJECTIVE: During 1985-1986, S-Cubed Corporation developed an integrated instrument package, a turnkey device, allowing relatively unskilled operators to perform same-day analyses of trichloroethylene (TCE) in Air Force bases' water sources. The system was installed at Wurtsmith AFB and tested during 1986-1987. The objective of Phase II, of this project, is to expand the instrument's capability by incorporating modifications to permit simultaneous quantification of as many as 11 VOCs in each sample.

APPROACH: Hardware, software, and methodology will be reviewed and redesigned, as necessary. After installation of the instrument and orientation of the operator, reliability tests will consist of comparison of VOC analyses of split samples performed by base personnel onsite and by an "EPA-approved" private laboratory, similar to the program of reliability testing of TCE analyses in Phase I. Reliability data will be submitted to EPA as justification of request that VOC monitor be "EPA-approved" as a local alternate test procedure (ATP).

START DATE: Aug 87 FINAL PRODUCT DUE DATE: May 90

WORK CONDUCTED BY: S-Cubed Corporation
La Jolla CA

MILESTONES:

1.	Redesign Hardware and Revise Software	May 89
2.	Bench-Test System and Internal Standards	Jun 89
3.	Draft of Instrument Operating and Maintenance Manual	Jun 89
4.	Application to EPA for Local ATPs	Jul 89
5.	Split-Sample Analysis Program	Apr 90
6.	Final Report	May 90

PROJECT OFFICER: Dr Joseph D. Wander, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Environmental Impact Assessment

TITLE: Atmospheric Dispersion of Rocket Propellants

WORK UNIT: 21032014

OBJECTIVE: Demonstrate the feasibility of using a small computer to run the three-dimensional (3D) Los Alamos National Laboratory (LANL) Higher Order Turbulence Model for Atmospheric Circulations/Random Particle Transport and Diffusion (HOTMAC/RAPTAD) program, with specific application to the complex terrain and meteorological conditions of Vandenberg AFB CA (VAFB). In addition, the contractor will investigate incorporation of nonneutrally buoyant source capability in HOTMAC/RAPTAD.

APPROACH: In Phase I, ground-level toxic releases at VAFB will be simulated on an IBM-AT class computer using HOTMAC/RAPTAD and one other model. Phase II will include coding the model for operation on a MicroVax computer (of the type used at VAFB) and repeating the release scenarios and intermodel comparisons accomplished in Phase I. In Phase III, positively and negatively buoyant source capability will be added to the model code and a test case release scenario will be run. In all phases, 3D model windflow will be compared with high-quality archived VAFB data sets provided by the Naval Postgraduate School.

START DATE: Apr 88 FINAL PRODUCT DUE DATE: Nov 89

WORK CONDUCTED BY: Los Alamos National Laboratory
Los Alamos NM

MILESTONES:

1.	Phase I - AT Model Evaluations	Oct 88
2.	Phase II - MVax Model Runs and Comparisons	May 89
3.	Phase III - Buoyancy Effects	Aug 89
4.	Final Report	Nov 89

PROJECT OFFICER: Capt Michael T. Moss, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Environmental Impact Assessment

TITLE: Hydrogen Fluoride (HF) Dispersion Model

WORK UNIT: 21032015

OBJECTIVE: Produce or adapt a microcomputer-based atmospheric transport and diffusion model for calculating toxic corridors applicable to a spill involving HF or a fluorine (F) leak with formation of a resultant HF aerosol and vapor cloud. The model will provide Air Force Weapons Laboratory (AFWL) and other Air Force activities, utilizing F or HF, with enhanced emergency planning and response capability.

APPROACH: Initially, potential HF spill scenarios will be investigated, to collect and develop information on the chemical and thermodynamic character of the source cloud. These characteristics include, or depend on, the release type (liquid or gaseous), release rate, HF formation rate, (for a fluorine release), and partitioning of the cloud between gas and aerosol form. The degree of dense gas (slumping) behavior induced by aerosol and refrigeration effects will also be investigated. The second part of the study will incorporate HF source and diffusion algorithms suggested by the earlier work into the Air Force Dispersion Research Model (ADAM). The resulting code will be tested against available HF experimental release data (the 1986 Lawrence Livermore-AMOCO Gold Fish series, for example).

START DATE: Dec 88 FINAL PRODUCT DUE DATE: Nov 89

WORK CONDUCTED BY: Technology Management Systems, Inc.
Burlington MA

MILESTONES:

1.	Literature Review	Jan 89
2.	Source Cloud Characterization	May 89
3.	Incorporate HF in Selected Model	Jul 89
4.	Test Code Against Field Studies	Sep 89
5.	Final Report	Nov 89

PROJECT OFFICER: Capt Michael T. Moss, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Solvent Capacity Field Test Method

WORK UNIT: 21036093

OBJECTIVE: Transfer the technology developed in a recently completed project, "Solvent Capacity," to field personnel to determine when used solvents should be changed. Implementation of these techniques will maximize solvent use before disposal or recycle in cold-cleaning and vapor-degreasing operations.

APPROACH: This project will provide field test kits, operations manuals, and training sessions to field personnel. Test kits will be used for 6 months at a dozen bases to evaluate solvent quality by simple physico-chemical techniques. Random samples will be evaluated at the contractor's laboratory facilities using the same techniques. The contractor will upgrade the test kits and operations manuals based on field comments and field experience.

START DATE: Sep 87 FINAL PRODUCT DUE DATE: Oct 89

WORK CONDUCTED BY: Auburn University
Auburn AL

MILESTONES:

1.	Fabrication of Test Kits and Preparation of Operations Manuals	Apr 88
2.	Delivery of Test Kits and Training	Sep 88
3.	Field Test Evaluation	Apr 89
4.	Upgrade Test Kits and Manuals	Jun 89
5.	Final Report	Oct 89

PROJECT OFFICER: Mr. Surendra B. Joshi, RDVS, (904) 283-4235, AUTOVON 523-4235

THRUST: Environmental Compliance

TECHNICAL AREA: Pollution Control

TITLE: Volatile Organic Compound (VOC) Control Technology

WORK UNIT: 21037097

OBJECTIVE: Develop a method to minimize the escape of volatile organic compounds (VOCs) from routine operations at typical Air Force bases. Routine operations will include painting-depainting, metal cleaning, fuel-defueling-transfer, and industrial waste treatment.

APPROACH: This program includes VOC emission survey, emission inventory validation, and identification of control concepts that may be used by Air Force facilities. Survey will involve onsite assessment of problems. Emission inventory validation will include sampling and analysis of emissions from specific sources. The contractor will recommend control concepts to test on a pilot-scale with estimation of VOC emissions reduction and cost per ton of VOC reduction when such concepts are implemented. Cost of pilot testing and facility modification, needed to conduct pilot tests, will also be included in the engineering feasibility design reports for each of four operations.

START DATE: Feb 87 FINAL PRODUCT DUE DATE: Jun 90

WORK CONDUCTED BY: Acurex Corporation
Mountain View CA

1. Survey of Facilities	
Paint Spray Booths at McClellan AFB and Travis AFB CA	Mar 87
Paint Spray Booths and Solvent Cleaning Facilities at Hill AFB UT and Newark AFB OH	Aug 88
Vapor-Degreasing Facilities at Robins AFB GA	Apr 89
2. Work plan for Emissions Validation	
McClellan CA and Travis AFB CA Paint Spray Facilities	May 87
Hill AFB UT and Newark AFB OH Facilities	Sep 88
Vapor-Degreasing Facilities at Robins AFB GA	Aug 89
3. Emissions Validation Study	
McClellan AFB and Travis AFB paint Spray facilities	Jun 87
Hill AFB UT and Newark AFB OH Facilities	Dec 88
Vapor-Degreasing Facilities at Robins AFB GA	Sep 89
4. Engineering Feasibility Reports	
McClellan AFB and Travis AFB CA Facilities	Jan 88
Hill AFB UT and Newark AFB OH Facilities	May 89
Vapor-Degreasing Facilities at Robins AFB GA	Jan 90
5. Final Report	Jun 90

PROJECT OFFICER: Mr. Surendra B. Joshi, RDVS, (904) 283-4235, AUTOVON 523-4235

THRUST: Environmental Compliance

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Ion-Vapor Deposition of Aluminum as a Replacement for Cadmium Electroplating

WORK UNIT: 21037102

OBJECTIVE: This project is designed to minimize hazardous waste produced in the electroplating shops of the Air Logistics Centers (ALCs) by eliminating the cadmium electroplating process. The objective of this effort is to demonstrate that ion-vapor deposition (IVD) of aluminum is an acceptable substitute for cadmium electroplating and provide a full-scale demonstration at an ALC.

APPROACH: Data will be gathered on all parts that are presently being cadmium electroplated by the Air Force at the ALCs. A database of all previous testing, that has occurred using the IVD process, will be provided. Correlation of the two sets of data will reveal the testing that remains to be completed. Remaining testing will be completed and areas requiring further research will be defined. A demonstration of the technologies ability to eliminate cadmium electroplating will be performed. The technical orders will be modified to reflect the process changes. This will be through a DOE contract.

START DATE: Oct 87 FINAL PRODUCT DUE DATE: Sep 90

WORK CONDUCTED BY: EG&G Idaho, through DOE contract
Columbus OH

MILESTONES:

1.	Develop Database	Jun 88
2.	Provide Economics	Jun 88
3.	Identify Research Needs	Jun 88
4.	Quick-Look Report	Jun 88
5.	Draft Report	Aug 88
6.	Phase II - Purchase of Equipment and Research and Development	Sep 89
7.	Phase III - Full-Scale Demonstration	Sep 90
8.	Final Report	Sep 90

PROJECT OFFICER: Mr Charles Carpenter, RDVS, (904) 283-2942, AUTOVON 523-2942

THRUST: Hazardous Wastes

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Noncyanide Strippers to Replace Cyanide Strippers

WORK UNIT: 21037103

OBJECTIVE: Develop a method to minimize hazardous waste produced by the electroplating shops of the Air Logistics Centers (ALCs) by replacing the cyanide stripping operations with noncyanide substitutes. Cyanide strippers contribute to the cyanide wastes which reach the industrial waste treatment plant by way of wastewater and contaminated plating baths costs Tinker AFB about $169,600 per year for treatment and disposal. Elimination of cyanides would eliminate these costs and health and safety problems would be greatly reduced.

APPROACH: Noncyanide baths are available that can replace most cyanide baths presently in use. The approach will be to technically justify the use of these baths, solve any process problems that result from substitution of these baths and insert these new bath requirements into the technical orders. For processes with no immediate replacement, research and development will be done to develop a replacement. This project will provide pilot-plant testing of replacement processes on actual aircraft parts to complete technical justification requirements. The ability of the changes to eliminate cyanides will be shown by choosing a demonstration site and demonstrating the processes on a large scale. This will be accomplished through a DOE contract.

START DATE: Oct 88 FINAL PRODUCT DUE DATE: Sep 90

WORK CONDUCTED BY: EG&G Idaho, through DOE contract
Columbus OH

MILESTONES:

1.	Review of Literature, Product Information, and Air Force Requirements	Mar 88
2.	Test Selected Replacement Processes, Using Generic Testing Where Possible	Jun 88
3.	Identify Biological Characteristics	Jun 88
4.	Establish Database	Jun 88
5.	Quick-Look Report	Jun 88
6.	Preliminary Testing	Aug 88
7.	Phase I - Final Report	Sep 88
8.	Phase II - Testing and Development of Processes	Sep 89
9.	Phase III - Demonstration of Technology	Sep 90
10.	Final Report	Sep 90

PROJECT OFFICER: Mr Charles Carpenter, RDVS, (904) 283-2942, AUTOVON 523-2942

THRUST: Environmental Compliance

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Biodegradable Solvents and Cleaners as Replacements for Halogenated and Hydrocarbon Solvents and Cleaners

WORK UNIT: 21037104

OBJECTIVE: Evaluate the feasibility of eliminating halogenated and hydrocarbon solvents by developing of an Air Force-wide program for testing specific biodegradable solvents and cleaners as substitutes. Evaluate requirements for a testing program to apply Air Force-wide for testing of biodegradable solvents and cleaners. Develop a program for determination of the impact of switching to biodegradable solvents and cleaners on the wastewater collection and treatment centers.

APPROACH: Data will be gathered on solvents and cleaners presently in use at Air Logistics Centers (ALCs) and on possible biodegradable substitutes for these products. Testing requirements will be determined to allow acceptance of biodegradable products by the ALCs. These procedures will then become the test plan for future testing of biodegradable solvents and cleaners for the Air Force. The effects of switching to biodegradable solvents and cleaners on the wastewater collection and treatment systems will also be determined. The project will conclude with a full-scale demonstration at Tinker AFB (Phase III). Work will be completed through DOE contract.

START DATE: Oct 87 FINAL PRODUCT DUE DATE: Sep 90

WORK CONDUCTED BY: EG&G Idaho, through DOE contract
Columbus OH

MILESTONES:

1.	Review of Literature and Product Information	Oct 87
2.	Review of Solvents and Cleaners in Use at the ALCs	Dec 87
3.	Develop Test Plan for Replacement Candidates	Feb 88
4.	Determine Candidate List	Feb 88
5.	Develop Test Plan for Impact on Industrial Waste Treatment Plants	Feb 88
6.	Draft Report	Mar 88
7.	Phase II - Determine Suitable Substitutes (Testing)	Sep 89
8.	Phase III - Full-Scale Demonstration	Sep 90
9.	Final Report	Sep 90

PROJECT OFFICER: Mr Charles Carpenter, RDVS, (904) 283-2942, AUTOVON 523-2942

THRUST: Hazardous Wastes

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Spray Casting as an Alternative for Electroplating

WORK UNIT: 21037108

OBJECTIVE: Develop a method to minimize hazardous waste produced by the electroplating shops of the Air Logistics Centers (ALCs) by reducing or eliminating liquid wastes from chromium, cadmium, and other electroplating processes. Conventional electroplating processes result in large volumes of used electroplating baths and rinse waters which require treatment and generate large quantities of hazardous waste. The project will develop technology to replace conventional electroplating processes with a spray-casting metallizing process, which has the potential to reduce or eliminate hazardous waste generation from many electroplating operations.

APPROACH: Spray casting is a process in which molten metal is aspirated into the gas stream by the Bernouli principle where, it is broken up into fine droplets and sprayed onto the part to be plated. The droplets are partially cooled in flight and compacted against a base metal to form a thin coating. This process is expected to eliminate many "bath" type electroplating processes, eliminate the need for hazardous chemicals in the work environment, eliminate the hazardous waste cleanup as a result of the electroplating processes now used, and reduce production costs by reducing coating times and chemical and hazardous waste disposal costs. A base, such as Tinker AFB, could realize savings of over $500K per year. Validation of the process for low-temperature metals will be shown by laboratory-scale demonstration. The project will demonstrate the economical and environmental benefits of doing additional work for high temperature metals. This will be accomplished through DOE contract.

START DATE: Oct 89 FINAL PRODUCT DUE DATE: Sep 91

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Design, Construct, and Operate Integrated Components of Spray System to Verify Concept	Apr 89
2.	Spray Low-temperature Coatings on Steel Sheet to Establish Operational Parameters.	May 89
3.	Produce Coated Product to Test Physical Characteristics	Jul 89
4.	Phase II - High-Temperature Coatings	Sep 90
5.	Phase III - Design and Analysis for Full-Scale Demonstration	Sep 91
6.	Technical Report	Sep 91

PROJECT OFFICER: Mr Charles Carpenter, RDVS, (904) 283-2942, AUTOVON 523-2942

THRUST: Hazardous Wastes

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Laser-Enhanced Electroplating

WORK UNIT: 21037109

OBJECTIVE: Develop a method to minimize hazardous waste produced by the electroplating shops of the Air Logistics Centers (ALCs) by reducing or eliminating liquid wastes from chromium, cadmium, and other electroplating processes. Conventional electroplating processes result in large volumes of used electroplating baths and rinse waters which require treatment. The treatment process for these wastes generates large quantities of hazardous waste which must be disposed of at an approved hazardous waste disposal facility.

APPROACH: Laser-enhanced jet electroplating is a process that could replace conventional electroplating. A free-standing jet of electrolyte is sprayed from a pressurized chamber through a nozzle and impinges upon a cathode. A laser beam is focused into the electrolytic stream so that it acts as a light guide directing the radiation to the cathode. The anode is housed in the pressurized chamber thus, restricting anode-to-cathode current flow to the region of the jet stream and allowing maskless, high-efficiency electroplating. Validation of the process will be shown by laboratory-scale demonstration of a laser-enhanced jet electroplating process for applying coatings. The project will demonstrate the potential economical and environmental benefits of a large-scale system. This work will be completed through DOE contract.

START DATE: Oct 89 FINAL PRODUCT DUE DATE: Sep 91

WORK CONDUCTED BY: To be determined

MILESTONES:

1.	Complete Nozzle and Containment System Design	Mar 90
2.	Construct Bench-Scale Test Unit	May 90
3.	Complete Preliminary System Testing	Jun 91
4.	Modify Design as Necessary	Jul 91
5.	Complete Jet-Electrochemistry Study	Sep 91
6.	Final Report	Sep 91

PROJECT OFFICER: Mr Charles Carpenter, RDVS, (904) 283-2942, AUTOVON 523-2942

THRUST: Environmental Compliance

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Hazard Response Modeling Uncertainty-Phase II

WORK UNIT: 30050017

OBJECTIVE: To refine and apply software comprising an objective framework for evaluation of microcomputer-based hazard response models. The study will quantify the uncertainties in model output due to: (1) the stochastic nature of atmospheric turbulence, (2) model physics errors/assumptions, and (3) input data errors arising from meteorological instrument response characteristics, biases, and siting considerations. This should allow specification of confidence intervals to aid in operational interpretation of model results.

APPROACH: A model evaluation approach developed in Phase I of this project will be applied to a number of dispersion models of interest to the Air Force (to include ADAM, AFTOX, CHARM, DEGADIS, and OB/DG), and refined using model results versus published field test data sets to be collected and archived by the contractor. Analyses of input data uncertainty will include field tests of boundary layer wind spatial/temporal coherence as a function of sensor spacing and averaging time (Boulder CO) and operational Air Force meteorological sensor uncertainty (Patrick AFB FL and nearby ranges).

START DATE: Mar 89 FINAL PRODUCT DUE DATE: Feb 91

WORK CONDUCTED BY: Sigma Research Corporation
Westford MA

MILESTONES:

1.	Field Studies Archived	May 89
2.	Models Archived	Dec 89
3.	Model Evaluation Software	Apr 90
4.	Stochastic - Input Data Uncertainties	Sep 90
5.	Software Application and Model Evaluations	Dec 90
6.	Final Report	Feb 91

PROJECT OFFICER: Capt Michael T. Moss, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Disposal of Solid Rocket Motors and Propellants

WORK UNIT: 30050050

OBJECTIVE: Develop an environmentally safe disposal method for solid rocket propellants. The only methods currently available for disposal of solid rocket propellants are open burning/open detonation and static firing. Because solid propellants contain ammonium perchlorate as the oxidizer, they release large quantities of hydrogen chloride gas when burned. Since HCl is toxic and corrosive, OB/OD and static firing may not be permitted in the near future. Disposal of solid-rocket propellants by supercritical water oxidation will provide a means for demilitarizing and refurbishing solid-rocket motors without generating hazardous byproducts.

APPROACH: This Phase I effort will demonstrate the technical feasibility of SCWO through bench-scale tests. The bench-scale studies will determine the optimum design parameters and conditions for a full-scale system. Experiments will be conducted to determine if the organic binder can be oxidized effectively without significant oxidation of the aluminum fuel. Additional experiments will be conducted to determine if ammonium chloride can be recovered as the principal product of ammonium perchlorate treatment. A preliminary process design and a cost estimate for a full-scale system will be conducted.

START DATE: Aug 89 FINAL PRODUCT DUE DATE: Feb 90

WORK CONDUCTED BY: Modell Development Corporation
Framingham MA

MILESTONES:

1.	Start Experiments	Aug 89
2.	Final Report	Feb 90

PROJECT OFFICER: Capt Mark D. Smith, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Pollution Control

TITLE: Real-Time Particle Measurement

WORK UNIT: 30050051

OBJECTIVE: Develop technology to measure smoke particle mass and size distribution from jet engine test cells, jet engine exhaust nozzles, and rocket engine exhausts. Current particle sizing/mass measurements require 20 minutes to an hour sampling time for a suitably large sample to be collected. Real-time measurement would significantly reduce the sampling time, thus saving engine time and fuel, and reducing analytical costs. A turn-key system will reduce the skill level required to perform the emissions sampling and make in-house sampling practical.

APPROACH: The technique, photothermal laser deflection (PLD), is based on the deflection experienced by a laser beam that travels thru a thermal lens. A pulsed laser beam locally heats the particles present in the exhaust thus changing the index of refraction of the surrounding gas and forming a thermal lens. A probe continuous wave laser, which travels thru the thermal lens, will be deflected accordingly. The amount of deflection is proportional to the local mass concentration. Since the heat absorbed by the particles is not a strong function of particle shape, PLD can work with particle clusters. The laser can also be tuned to pump a gaseous species of interest thus forming another thermal lens. Therefore, PLD has the potential to measure the concentration of gaseous species such as NO_x, CO2, and CO. Both modelling and experimental work will be conducted during Phase I to establish the feasibility of the proposed technique. The method will also be tested in the exhaust of a small rocket motor firing.

START DATE: Aug 89 FINAL PRODUCT DUE DATE: Feb 90

WORK CONDUCTED BY: MetroLaser
Irvine CA

MILESTONES:

1.	Start Experiments	Aug 89
2.	Final Report	Feb 90

PROJECT OFFICER: Capt Mark D. Smith, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Environmental Impact Assessment

TITLE: A Real-Time Hazardous Chemical Emission Rate Monitoring Device

WORK UNIT: 30050052

OBJECTIVE: Design an instrument system capable of accurately measuring the source strength of accidental chemical releases. The device will be capable of measuring hypergolic fuel (hydrazines) and oxidizer (nitrogen tetroxide) at parts-per-million levels and will measure in real-time with a time constant of less than 60 seconds. This system will provide improved estimates of a critical dispersion model input parameter and source strength, near hypergolic storage facilities and launch sites.

APPROACH: Surface-enhanced Raman Spectroscopy (SERS) will be used as the vapor concentration detection method. SERS spectra of hypergolic propellants and other chemicals of Air Force interest will be measured. Substrate materials will be characterized as to their applicability for these chemicals. Response times and reversibility properties will be determined. Multicomponent gas mixtures will be tested to establish how well the technique resolves individual chemical species. Based on test results, the feasibility of building an economical and effective system will be assessed.

START DATE: Jul 89 FINAL PRODUCT DUE DATE: Feb 90

WORK CONDUCTED BY: EIC Laboratories
Norwood MA

MILESTONES:

1.	SERS Spectra Measured	Sep 89
2.	Substrate Response Tested	Oct 89
3.	Reversibility Determined	Nov 89
4.	Mixture Resolution Tested	Jan 90
5.	Final Report	Feb 90

PROJECT OFFICER: Capt Michael T. Moss, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Pollution Control

TITLE: Catalytic-Additive Combustor

WORK UNIT: 30050053

OBJECTIVE: Develop a catalytic ingredient for the lining of a turbine engine combustor. A metal oxide catalyst will be mixed in a ceramic combustor lining to enhance free-radical-propagated combustion. Combustion efficiency should be improved while decreasing exhaust emissions of hydrocarbons.

APPROACH: A catalyst will be chosen by developing a bench-scale combustor containing metal oxide in a tube of fixed length. A fuel-air-additive mixture will pass through the tube and combustion products will be measured. The catalyst with the best performance will then be tested in an actual gas turbine aircraft engine to evaluate its effect on engine performance.

START DATE: Sep 89 FINAL PRODUCT DUE DATE: Mar 90

WORK CONDUCTED BY: Precision Combustion, Inc.
New Haven CT

MILESTONES:

1.	Catalyst Selection	Oct 90
2.	Combustor Testing	Jan 90
3.	Final Report	Mar 90

PROJECT OFFICER: Capt Wayne P. Chepren, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Pollution Control

TITLE: Hazardous Waste Surrogate Test in Incinerator

WORK UNIT: 37880001

OBJECTIVE: Utilize a surrogate chemical to simplify proving destruction/ removal efficiency for the incineration of Air Force hazardous waste.

APPROACH: Thermal destruction tests of Air Force Organics Waste Mixture spiked with SF_6 will be conducted in a commercial hazardous waste incinerator and an Air Force boiler. Destruction of SF_6 and organics will be monitored under various combinations of temperatures, oxygen levels, and load conditions.

START DATE: Apr 89 FINAL PRODUCT DUE DATE: Dec 90

WORK CONDUCTED BY: MRI, Inc.
Kansas City MO

MILESTONES:

1.	Selection of POHCs and Test Site	Jun 89
2.	Develop Test Plan	Aug 89
3.	Conduct a Test at Hazardous Waste Incinerator	Sep 89
4.	Conduct a Test at Air Force Boiler	Jul 90
5.	Final Report and User's Guide	Dec 90

PROJECT OFFICER: Mr Surendra B. Joshi, RDVS, (904) 283-4235, AUTOVON 523-4235

THRUST: Environmental Compliance

TECHNICAL AREA: Hazardous Waste Reduction

TITLE: Plastic Media Blasting Waste Treatment

WORK UNIT: 37880002

OBJECTIVE: Develop a plastic media waste treatment system and to reduce the plastic media waste volume by 90 to 95 percent This project is a follow-on to the Plastic Bead Blasting Residue Project, which identified technologies capable of reducing the plastic media hazardous volume.

APPROACH: A systems approach will be adopted in the development of this waste treatment program to include pretreatment, separation, packaging, and recycling. Liquid density separation using inorganic solutions will be studied in depth. The treatment scheme must be effective in treating both thermoplastic and thermoset media.

START DATE: Jun 89 FINAL PRODUCT DUE DATE: Jun 91

WORK CONDUCTED BY: Oak Ridge National Laboratories
Oak Ridge TN

MILESTONES:

1.	Bench-Scale Verification	Dec 89
2.	Pilot-Scale Design	Feb 89
3.	Pilot-Unit Installation	Jun 90
4.	Pilot-Scale Tests Completed	Mar 91
5.	Final Report	Jun 91

PROJECT OFFICER: Capt Helen Williams, RDVS, (904) 283-4234, AUTOVON 523-4234

THRUST: Environmental Compliance

TECHNICAL AREA: Pollution Control

TITLE: Volatile Organic Compound (VOC) Control Technology - Phase II

WORK UNIT: 37883068

OBJECTIVE: Minimize the escape of volatile organic compounds (VOCs) from routine operations at typical Air Force bases. Routine operations will include painting-depainting, metal cleaning, fueling-defueling-transfer, and industrial waste treatment.

APPROACH: The contractor will design and conduct pilot-scale tests of recommended VOC control concepts for four operations. Based on the results of pilot studies, the contractor will submit a technical report. The report will include facility design, capital and operating cost estimates, VOC emissions reduction estimates, and cost per ton of VOC reduction expected when facilitization is complete. The report should also include cost per ton of VOCs reduced by alternate control technologies.

START DATE: Dec 87 FINAL PRODUCT DUE DATE: Dec 90

WORK CONDUCTED BY: Acurex Corp
Mountain View CA

MILESTONES:

1.	Work Plan for Pilot Tests	
	At a paint spray booth facility	Mar 89
	At a precision cleaning facility	Sep 89
	At a vapor degreasing facility	Mar 90
2.	Pilot Tests for VOC-Control Technologies	
	At a paint spray booth facility	May 89
	At a precision cleaning facility	Jan 90
	At a vapor degreasing facility	Jan 90
3.	Facility Design Final Reports	
	For a paint spray booth facility	Sep 89
	For a precision cleaning facility	Jun 90
	For a vapor degreasing facility	Dec 90

PROJECT OFFICER: Mr. Surendra B. Joshi, RDVS, (904) 283-4235, AUTOVON 523-4235